A

NEW AND CONCISE

SYSTEM OF ARITHMETIC,

CALCULATED TO FACILITATE

THE

IMPROVEMENT OF YOUTH IN UPPER CANADA.

Published by Subscription,

UNDER THE PATRONAGE OF HIS EXCELLENCY,

SIR JOHN COLBORNE, K. C. B.

LIEUT. GOVERNOR OF THE PROVINCE OF UPPER CANADA, &c.

The Honourable and Venerable

THE ARCHDEACON OF YORK,

THE REV. DR. HARRIS, PRINCIPAL OF THE COLLEGE, &c.

BY WILLIAM PHILLIPS,

Teacher of Writing, Arithmetic, Geography, &c. in Ladies Schools, and in private Families.

The advantage of fractions is so great that I dare affirm it, a person who is well acquainted with them, will, in many cases, perform as many calculations as four or five who are not.

DR. HUTTON.

YORK:

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RECOMMENDATION.

York, 31*st May*, 1832.

Sometime, ago Mr. PHILLIPS left with me, a copy of a short *Treatise on Arithmetic*, of which I think highly, as proceeding upon a clear and simple principle, easy of comprehension, and am of opinion, that with a very few alterations to adapt it to the business of the country, it might with great advantage be introduced into the Common Schools in the Province.

JOHN STRACHAN.

The Author has made the *alterations* suggested by his Honourable and Venerable PATRON.

PREFACE.

MANY Excellent works have been published on the Science of Arithmetic; but it appears to the Author, that a Treatise calculated to initiate youth into that branch of the Science which is immediately applicable to business, would be still a desideratum; with this view he has endeavoured to arrange the present system in as concise and easy a form as possible, consistent with perspicuity—to divest it of whatsoever might tend to perplex the youthful mind—to perform every operation upon one general principle, which is so scientifically founded as to elicit the spontaneous efforts of the pupils, to establish the judgment, to exercise the imagination, and to assist the memory. Hereby, the pupil with immensely less figures, with the greatest despatch, and with the most perfect accuracy, will be enabled, in incomparably less time than by any other system, to perform the most intricate calculations, (and the generality of commercial computations even by the *mental powers alone :)* thus the most

expeditious and practical application of theoretical arithmetic is made, to whatever purpose its aid may be called for in business; being assured, that to the busy tradesman, whose principal desire is to know the value of a given quantity at a given ratio, the more expeditiously the operation is performed the more acceptable it will prove.

Algebra is founded upon Vulgar Fractions, which is the basis of the system now presented to the public; therefore the Author presumes it will be found equally advantageous to those who are intended for mathematical pursuits.

The experience the Author has had in Ladies Seminaries of the first respectability enables him to judge of the capacity of the fair sex, and he is confident from the attention and docility of young ladies, in general, that he will be justified in presenting to them the above system, which was primarly intended for their use.

York, U. C. 1*st July*, 1833.

A NEW

System of Arithmetic.

ARITHMETIC is the art of computing by numbers, and all its operations are performed by increasing or decreasing given quantities; addition or multiplication being the increasing term; subtraction or division the decreasing term—thus.

Increasing Ter

$2 + 2 = 4$, $4 + 4 = 8$, $= 16$
$2 \times 2 = 4$, $4 \times 2 = 8$, $= 16$

Decreasing Terms.

$16 - 8 = 8$, $8 - 4 = 4$, $4 - 2 = 2$
$16 \div 2 = 8$, $8 \div 2 = 4$, $4 \div 2 = 2$

Digits or figures, are marks by which numbers are expressed, and are the nine following, viz: 1 one, 2 two, 3 three, 4 four, 5 five, 6 six, 7 seven, 8 eight, 9 nine; to which we may add the cypher 0 or nought, which is of no value when taken by itself, but being annexed to the right hand of a digit increase it tenfold—thus, 50 signifies fifty.

An Integer is any whole quantity or number, as 1, 2, 3, 23, 754, &c.

A fraction or broken number is an impression for any assignable part or parts of an integer—thus, $\frac{15}{20}$ or $\frac{3}{4}$ of a pound are assignable parts for 15 shillings.

Compound numbers are such as consist of integers and fractional parts—thus,

54£ 13s. 4d. or 54 $\frac{2}{3}$ £,

Numeration informs us in what manner we are to express and accommodate numbers to the various purposes of business, it consists principally, of Addition, Subtraction, Multiplication and Division, to which the following tables are subservient.

Arithmetical Characters, Tables, &c.

ARITHMETICAL CHARACTERS.

+	Plus, or more,	the sign of Addition.
—	Minus, or less	" Subtraction.
×	Multiplied by	" Multiplication.
÷	Divided by	" Division.
=	Equal to	" Equality.
:	Is to	Signs of proportion.
: :	So is	
:	To	

NUMERATION

Table.

1	Units
21	Tens
321	Hundreds
4,321	Thousands
54,321	Tens of Thousands
654,321	Hundreds of Thousands
7;654,321	Millions
87;654,321	Tens of Millions
987;654,321	Hundreds of Millions
1,987;654,321	Thousands of Millions
21,987;654,321	Tens of Thousands of Millions
321,987;654,321	Hundreds of Thousands of Millions
4;321,987;654,321	Billions

Addition and Subtraction Table.

1	2	3	4	5	6	7	8	9
2	4	5	6	7	8	9	10	11
3	5	6	7	8	9	10	11	12
4	6	7	8	9	10	11	12	13
5	7	8	9	10	11	12	13	14
6	8	9	10	11	12	13	14	15
7	9	10	11	12	13	14	15	16
8	10	11	12	13	14	15	16	17
9	11	12	13	14	15	16	17	18

Multiplication Table.

8	10	11	12	13	14	15	16	17
9	11	12	13	14	15	16	17	18

Multiplication Table.

1	2	3	4	5	6	7	8	9	10	11	12
2	4	6	8	10	12	14	16	18	20	22	24
3	6	9	12	15	18	21	24	27	30	33	36
4	8	12	16	20	24	28	32	36	40	44	48
5	10	15	20	25	30	35	40	45	50	55	60
6	12	18	24	30	36	42	48	54	60	66	72
7	14	21	28	35	42	49	56	63	70	77	84
8	16	24	32	40	48	56	64	72	80	88	96
9	18	27	36	45	54	63	72	81	90	99	108
10	20	30	40	50	60	70	80	90	100	110	120
11	22	33	44	55	66	77	88	99	110	121	132
12	24	36	48	60	72	84	96	108	120	132	144

MONEY.

Farthings.		Pence.			Shillings.		
qr.	*d.*	*s.*	*d.*		*s.*	*£*	*s.*
4 make	1	12 make	1	0	20 make	1	0
5 ..	$1\frac{1}{4}$	20 ..	1	8	30 ..	1	10
6 ..	$1\frac{1}{2}$	24 ..	2	0	40 ..	2	0
7 ..	$1\frac{3}{4}$	30 ..	2	6	50 ..	2	10
8 ..	2	36 ..	3	0	60 ..	3	0
9 ..	$2\frac{1}{4}$	40 ..	3	4	70 ..	3	10
10 ..	$2\frac{1}{2}$	48 ..	4	0	80 ..	4	0
11 ..	$2\frac{3}{4}$	50 ..	4	2	90 ..	4	10
12 ..	3	60 ..	5	0	100 ..	5	0
13 ..	$3\frac{1}{4}$	70 ..	5	10	110 ..	5	10
14 ..	$3\frac{1}{2}$	72 ..	6	0	120 ..	6	0
15 ..	$3\frac{3}{4}$	80 ..	6	8	130 ..	6	10
16 ..	4	84 ..	7	0	140 ..	7	0
17 ..	$4\frac{1}{4}$	90 ..	7	6	150 ..	7	10
18 ..	$4\frac{1}{2}$	96 ..	8	0	160 ..	8	0
19 ..	$4\frac{3}{4}$	100 ..	8	4	170 ..	8	10
20 ..	5	108 ..	9	0	180 ..	9	0
21 ..	$5\frac{1}{4}$	110 ..	9	2	190 ..	9	10
22 ..	$5\frac{1}{2}$	120 ..	10	0	200 ..	10	0
23 ..	$5\frac{3}{4}$	130 ..	10	10	300 ..	15	0
24 ..	6	132 ..	11	0	400 ..	20	0
25 ..	$6\frac{1}{4}$	140 ..	11	8	500 ..	25	0
48 ..	1s	144 ..	12	0	600 ..	30	0
960 ..	20s	240 ..	20	0	1000 ..	50	0

NOTE.—L. stands for Pounds (from libra being the Latin for pounds); S. for shillings, (from solidi); D. for pence, (from denarii); and Q. for farthings, (from quadrantes.)

FEDERAL MONEY.

10 mills,	make	1 cent,	marked	m. for mill,
10 cents,	..	1 dime,	..	cts. for cents,
10 dimes,	..	1 dollar,	..	d. for dime,
100 cents,	..	1 dollar,	..	$ for dollar,
10 dollars,	..	1 eagle,	..	E. for Eagle.

NOTE.—This character $ placed before a number, shows it to express Federal money. The eagle is a gold coin, the dollar and dime are silver coins, the cent is a copper coin, the mill is imaginary.

TROY WEIGHT.

				Marked.
24 Grains	make	1	pennyweight	gr.
20 Pennyweights	..	1	ounce	dwt.
12 Ounces	..	1	pounds	oz.
				lb.

gr.	dwt.			
24	1	oz.		
480	20	1	lb.	
5760	240	12	1	

AVOIRDUPOIS WEIGHT.

				Marked.
16 Drams	make	1	ounce	dr.
16 Ounces	..	1	pound	oz.
28 Pounds	..	1	quarter	lb.
4 Quarters or 112lb.	..	1	hundred weight	qr.
20 Hundred weight	..	1	ton	cwt.
				ton

dr.	oz.				
16	1	lb.			
256	16	1	qr.		
7168	448	28	1	cwt.	
28672	1792	112	4	1	ton.
573440	35840	2240	80	20	1

APOTHECARIES WEIGHT.

			Marked.
20	Grains	make 1 scruple	gr.
3	Scruples	.. 1 dram	sc.
8	Drams	.. 1 ounce	dr.
12	Ounces	.. 1 pound	oz.
			lb.

grs.	sc.			
20	1	dr.		
60	3	1	oz.	
480	24	3	1	lb.
5760	288	96	12	1

WOOL WEIGHT.

			Marked.
7	Pounds	make 1 clove	cl.
2	Cloves or 14lb.	.. 1 stone	st.
2	Stone	.. 1 tod	t.
6½	Tods	.. 1 wey	w.
2	Weys	.. 1 sack	s.
12	Sacks	.. 1 last	la.

lb.	cl.					
7	1	st.				
15	2	1	tod			
28	4	2	1	w.		
182	25	13	6½	1	sa.	
364	52	26	13	2	1	la.
4368	624	312	156	24	12	1

LONG MEASURE.

				Marked.
				Bar.
3	Barley corns	make	1 inch	in.
12	Inches	..	1 foot	ft.
3	Feet	..	1 yard	yd.
6	Feet	..	1 fathom	fa.
5½	Yards	..	1 rood, pool, or perch	p.
4	Pools	..	1 chain	ch.
40	Pools	..	1 furlong	fur.
8	Furlongs	..	1 mile	m.
3	Miles	..	1 league	lea.
69	Geographical or Statute miles	..	1 degree	deg.
69½				

Marked.	bc.	in.	ft.	yd.	p.	fur.	m.
cl.	3	1					
st.	36	12	1				
t.	108	36	3	1			
w.	594	198	16½	5½	1		
s.	32760	7920	660	220	40	1	
la.	190080	63360	5280	1760	320	8	1

CUBIT OR SOLID MEASURE.

1728	Inches	make	1 solid foot.
27	Feet	..	1 yard.
40	Feet of rough timber	..	1 ton or load.
50	Feet hown timber		

SQUARE OR SUPERFICIAL MEASURE.

				Marked.
144	Inches	make 1	foot	ft.
9	Feet	.. 1	yard	yd.
100	Feet	.. 1	square of flooring	
272¼	Feet	.. 1	rod of brick work	
30¼	Yards	.. 1	pool	p.
16	Pools	.. 1	chain	ch.
40	Pools	.. 1	rood	r'd.
4	Roods	.. 1	acre	a.
4840	Yards	.. 1	acre	..
30	Acres	.. 1	yard	
640	Acres	.. 1	mile	m.

in.	ft.	yd.	p.	r'd.	a.
144	1				
1296	9	1			
39204	272¼	30¼	1		
1568160	10899	1210	40	1	
6272640	43560	4840	160	4	1

SURVEYING CHAIN.

				Marked.
7 92/25	Inches	make	1 link	lk.
25	Links or 5½ yards		1 pole	p.
4	Pls. 100 lks. or 22 yds.		1 chain	ch.
10	Chains		1 furlong	fur.
8	Furlongs or 80 Chains		1 mile	m.
10	Square Chains		1 acre	a.

Ten Chains in length and one in width, make an Acre.

CLOTH MEASURE.

				Marked.
$2\frac{1}{4}$	Inches	make 1	nail	n.
4	Nails	.. 1	quarter of a yard	yd.
3	Quarters	.. 1	Flemish ell	F. E.
4	Quarters	.. 1	yard	yd.
5	Quarters	.. 1	English ell	E. E.
6	Quarters	.. 1	French	Fr. E.

in.	n.	qr.		
$2\frac{1}{4}$	1	qr.		
36	16	4	1	yard
27	12	3	1	Flem. ell
45	20	5	1	Eng. ell
54	24	6	1	Fr. ell

WINE MEASURE.

				Marked.
4	Gills	make 1	pint	pt.
2	Pints	.. 1	quart	qt.
4	Quarts	.. 1	gallon	gl.
10	Gallons	.. 1	anchor	ank.
42	Gallons	.. 1	tierce	tier.
2	Tierce	.. 1	puncheon	pun.
63	Gallons	.. 1	hogshead	hhd.
2	Hogsheads	.. 1	pipe or butt	p.
2	Pipes	.. 1	ton	ton

pts.	qt.	gals.	tie.	hhd.	pun.		p.	
2	1							
8	4	1						
336	168	42	1					
504	252	63	1½	1				
672	336	84	2	1½	1	1		
1008	504	126	3	2	1½	1		ton
2016	1008	252	6	4	3	2		1

OLD MEASURE.		IMPERIAL MEASURE. Gal. qt. pt. gill. 100 pts.						
10 Gallons	equal	8	1	0	2	.58	or 1	anchor
18 Gallons	..	14	3	1	3	.87	1	runlet
42 Gallons	..	34	3	1	3	.70	1	tierce
63 Gallons	..	52	1	1	3	.55	1	hhd.
84 Gallons	..	69	3	1	3	.40	1	pun.
126 Gallons	..	104	3	1	3	.11	1	pipe
252 Gallons	..	209	3	1	2	.22	or 1	tun

ALE AND BEER MEASURE.

				Marked.
4 Gills	make	1	pint	pt.
2 Pints	..	1	quart	qt.
4 Quarts	..	1	gallon	gal.
9 Gallons	..	1	firkin	fir.
2 Firkins	..	1	kilderkin	kil.
2 Kilderkins	..	1	barrel	barl.
1½ Barrel	..	1	hogshead	hhd.
2 Barrels	..	1	puncheon	pun.
2 Hogsheads	..	1	pipe or butt	pipe.
2 Pipes	..	1	ton	ton.

pts.	qt.	gals.	fir.	kil.	barrl.	hhd.	pun.	butt.
2	1							
8	4	1						
72	36	9	1					
144	72	18	2	1				
288	144	36	4	2	1			
432	216	54	6	3	1½	1		
576	388	72	8	4	2		1	
864	432	108	12	6	3		2	1

OLD MEASURE.		IMPERIAL MEASURE. gal.	qt.	pt.	gill	100 pts.		
9 Gallons	equal	9	0	1	0	.91	or 1	firkin
18 Gallons	..	18	1	0	1	.82	. 1	kil.
36 Gallons	..	36	2	0	3	.64	. 1	barrel
54 Gallons	..	54	3	1	1	.45	. 1	hhd.
72 Gallons	..	73	0	1	3	.27	. 1	pun.
108 Gallons	..	109	3	0	2	.91	. 1	ton

DRY MEASURE.

			Marked:
4 Gills	make 1	pint	pt.
2 Pints	.. 1	quart	qt.
2 Quarts	.. 1	pottle	pot.
2 Pottles	.. 1	gallon	gal.
2 Gallons	.. 1	peck	peck.
4 Pecks	.. 1	bushel	bus.
4 Bushels	.. 1	coom	coom.
2 Cooms	.. 1	quarter	qr.
4 Quarters	.. 1	chaldron	chald.
5 Chaldrons	.. 1	wey	wey.
2 Weys	.. 1	last	la.

pts.	gal.	pk.	bus.	coom.	qr.	w.	la.
8	1						
16	2	1					
64	8	4	1				
256	32	16	4	1			
512	64	32	9	2	1		
2560	320	160	40	10	5	1	
5120	640	320	80	20	10	2	1

TIME.

			Marked sec.
60 Seconds	make	1 minute	m.
60 Minutes	..	1 hour	h.
24 Hours	..	1 day	d.
7 Days	..	1 week	w.
4 Weeks	..	1 month	mth.
12 Calendar mths or 365 days 6 h.	}	1 year	yr.

Sec.	m.	h.	d.	w.	m.	yr.
60	1					
3600	60	1				
86400	1440	24	1			
604800	10080	168	7	1		
2419200	40320	672	28	4	1	
31557600	525950	8766	365¼	52	13	1

Every fourth year has one day added, and is called Leap Year.

100 Years make 1 Century.

To know the Days in each Month.

Four months have thirty days we find,
To sev'n are thirty-one assign'd;
April in Spring the first we view,
In Summer June in lovely hue,
September also is one more,
And dull November makes the four:
But 'tis cold February's fate,
To be complete in twenty-eight,
Save that in leap year, (one in four,)
This month contains just one day more.

The Quarter Days are

Lady-day.....25th of March
Midsummer-day.....24th of June
Michaelmas-day.....29th of September
Christmas-day.....25th of December

ASTRONOMICAL MOTION.

				Marked
60	Seconds	make	1 minute	'
60	Minutes	..	1 degree	°
30	Degrees	..	1 signs of the Zodiac	s
12	Signs	..	1 great circle of ditto.	

Twelve Signs of the Zodiac.

SPRING.

NORTHERN.

Aries, the Ram.....	♈
Taurus, the Bull.....	♉
Gemini, the Twins.....	♊

SUMMER.

Cancer, the Crab.....	♋
Leo, the Lion.....	♌
Virgo, the Virgin.....	♍

AUTUMN.

SOUTHERN.

Libra, the Balance.....	♎
Scorpio, the Scorpion.....	♏
Sagittarius, the Archer.....	♐

WINTER

Capricornus, the Goat.....	♑
Aquarius, the Water-bearer.....	♒
Pisces, the Fishes.....	♓

FRACTIONAL TABLES.

1	Farthing is	$\frac{1}{4}$	of a Penny
2	..	$\frac{1}{2}$	..
3	..	$\frac{3}{4}$	..
1	Penny is	$\frac{1}{12}$	of a Shillings
$1\frac{1}{2}$	..	$\frac{1}{8}$	..
2	..	$\frac{1}{6}$	..
3	..	$\frac{1}{4}$	..
4	..	$\frac{1}{3}$	..
$4\frac{1}{2}$	..	$\frac{3}{8}$	..
5	..	$\frac{5}{12}$	..

6	Pence is	$\frac{1}{2}$	of a Shilling.
7	..	$\frac{7}{12}$	..
$7\frac{1}{2}$	..	$\frac{5}{8}$	..
8	..	$\frac{2}{3}$	..
9	..	$\frac{3}{4}$	....
10	..	$\frac{5}{6}$	..
$10\frac{1}{2}$	..	$\frac{7}{8}$	..
11	..	$\frac{11}{12}$	..
12	..	$\frac{12}{12}$	or 1 shilling

$3\frac{3}{4}$	Pence is	$\frac{1}{64}$	of a Pound.
4	..	$\frac{1}{60}$	....
5	..	$\frac{1}{48}$	....
6	..	$\frac{1}{40}$	....
$7\frac{1}{2}$	..	$\frac{1}{32}$	....
8	..	$\frac{1}{30}$	....
10	..	$\frac{1}{24}$	....

s.	*d.*			
1	0	Shilling is	$\frac{1}{20}$	of a Pound.
1	3	..	$\frac{1}{16}$	....
1	4	..	$\frac{1}{15}$	....
1	8	..	$\frac{1}{12}$	....
2	0	..	$\frac{1}{10}$	....
2	6	..	$\frac{1}{8}$	....
3	0	..	$\frac{3}{20}$	....
3	4	..	$\frac{1}{6}$	....
4	0	..	$\frac{1}{5}$	....
5	0	..	$\frac{1}{4}$	....
6	8	..	$\frac{1}{3}$	....
7	6	..	$\frac{3}{8}$	....
8	0	..	$\frac{2}{5}$	....

9	0	Shillings is	$\frac{9}{20}$	of a Pound.
10	0	..	$\frac{1}{2}$	....
11	0	..	$\frac{11}{20}$	....
12	0	..	$\frac{3}{5}$	....
12	6	..	$\frac{5}{8}$	....
13	0	..	$\frac{13}{20}$	....
13	4	..	$\frac{2}{3}$	....
14	0	..	$\frac{7}{10}$	....
15	0	..	$\frac{3}{4}$	....
16	0	..	$\frac{4}{5}$	....
17	0	..	$\frac{17}{20}$	....
17	0	..	$\frac{7}{8}$	....
18	0	..	$\frac{9}{10}$	....
19	0	..	$\frac{19}{20}$	....
20	0	..	$\frac{20}{20}$	or one Pound.

50	cents	is	$\frac{1}{2}$	of a dollar,
$33\frac{1}{3}$	..		$\frac{1}{3}$	....
25	..		$\frac{1}{4}$	....
20	..		$\frac{1}{5}$	....
$12\frac{1}{2}$	..		$\frac{1}{8}$	....
$6\frac{1}{4}$	..		$\frac{1}{16}$	....
5	..		$\frac{1}{20}$	....

TROY.

2	Grains	is	$\frac{1}{12}$	of a penny weight.
3	..		$\frac{1}{8}$	....
4	..		$\frac{1}{6}$	....
6	..		$\frac{1}{4}$	....
8	..		$\frac{1}{3}$	....
12	..		$\frac{1}{2}$	....

1	dwt. is		$\frac{1}{20}$	of an Ounce.
1	. 6	grs.	$\frac{1}{16}$	....
1	. 8	..	$\frac{1}{15}$	....
1	. 16	..	$\frac{1}{12}$	.....
2	. 0	..	$\frac{1}{10}$	....
2	. 12	..	$\frac{1}{8}$	....
3	. 8	..	$\frac{1}{6}$	....
4	. 0	..	$\frac{1}{5}$	....
5	. 0	..	$\frac{1}{4}$	....
6	. 16	..	$\frac{1}{3}$	....
10	. 0	..	$\frac{1}{2}$	....

1	Ounce is	$\frac{1}{20}$	of a Pound.
1	. 12 dwt.	$\frac{1}{8}$	....
2	. ..	$\frac{1}{5}$	....
3	. ..	$\frac{1}{4}$	....
4	. ..	$\frac{1}{3}$	....
6	. ..	$\frac{1}{2}$	....

AVOIRDUPOISE.

1	Ounce is	$\frac{1}{16}$	of a Pound.
2	..	$\frac{1}{8}$	....
4	..	$\frac{1}{4}$	....
8	..	$\frac{1}{2}$	....

2	Pounds is	$\frac{1}{14}$	of a quarter, or 28lbs.
3½	..	$\frac{1}{8}$	....
4	..	$\frac{1}{7}$	....
7	..	$\frac{1}{4}$	....
14	..	$\frac{1}{2}$	....

3½	Pounds is	$\frac{1}{16}$	of 2 quarters or 56 lbs.
4	..	$\frac{1}{14}$	....
7	..	$\frac{1}{8}$	....
8	..	$\frac{1}{7}$	....
14	..	$\frac{1}{4}$	....
28	..	$\frac{1}{2}$	....
7	Pounds is	$\frac{1}{16}$	of a hundred weight.
8	..	$\frac{1}{14}$	....
14	..	$\frac{1}{8}$	....
16	..	$\frac{1}{7}$	....
28	..	$\frac{1}{4}$	....
56	..	$\frac{1}{2}$	....
1	cwt. is	$\frac{1}{26}$	of a ton.
1	1 qr.	$\frac{1}{16}$	....
2	..	$\frac{1}{10}$	....
2	2	$\frac{1}{8}$	....
4	..	$\frac{1}{6}$	....
5	..	$\frac{1}{4}$	....
10	..	$\frac{1}{2}$	....

CLOTH MEASURE.

1	Nail is		$\frac{1}{16}$ of a Yard.
2	..		$\frac{1}{8}$
4	..		$\frac{1}{4}$
8	..	or 2 quarters	$\frac{1}{2}$

INTEREST TABLE.

	s.		*d.f.*		
¼	or 5 per cent. is		0½	⅔	in the £.
½	10	....	1	⅓	....
¾	15	....	1¾	⅛	....

INTEREST TABLE—Continued.

£			d.		in the £
1	per cent. is		2¼	⅗	....
1½	....		3		....
1½	....		3½	⅖	....
1¾	....		4	⅘	....
2	....		4¾	⅕	....
2¼	....		5¼	⅗	....
2½	....		6		....
2¾	....		6½	⅖	....
3	....		7	⅘	....
3¼	....		7¾	⅕	....
3½	....		8¼	⅗	....
3¾	....		9		....
4	....		9½	⅖	....
4¼	....		10	⅘	....
4½	....		10¾	⅖	....
4¾	....	s.	11¼	⅗	....
5	....	1	0		....
6	....	1	2¼	⅗	....
7	....	1	4¾	⅕	....
8	....	1	7	⅘	....
9	....	1	9½	⅖	....
10	....	2	0		....
12½	....	2	6		....
15	....	3	0		....
17½	....	3	6		....
20	....	4	0		....
25	....	5	0		....
30	....	6	0		....
50	....	10	0		....

Table of Miscellaneous Articles.

	lbs.
A firkin of butter is	56
A .. of soap	64
A barrel of potashes	200
A .. of anchovies	30
A .. of candles	120
A .. of soap	256
A .. of raisins	112
A .. of butter	224
A fother of lead is 19½ hundred weight.	2184
A stone of iron	14
A .. of butcher's meat	8
A .. of glass	5
A .. of hemp	32
A .. of cheese	16
A gallon of oil	7½
A faggot of steel	120
A peck of salt	14
A bushel of salt	56

12 Articles	1 dozen.
12 Dozen	1 gross.
20 Articles	1 score.
5 Score	1 common hundred.
6 Score	1 great hundred.
24 Sheets	1 quire of paper.
20 Quires	1 ream.
2 Reams	1 bundle.
5 Doz. skins parchment	1 Roll.

NOTATION.

Notation is the art of expressing numbers by figures, and teaches to read or write any sum or number required.

Write in figures the following numbers:

Twenty-seven.

Two hundred and ninety-eight.

Seven hundred and sixty-three.

Three thousand four hundred and five.

Twenty-five thousand seven hundred and fifty-two.

One hundred and thirty-seven thousand, four hundred and twenty-nine.

Four millions, eight hundred and sixty-five thousand, five hundred and fourteen.

Twenty-nine millions, three hundred and twenty-four thousand, six hundred and twenty-nine.

Eight hundred and twenty-four millions, two hundred and forty-three thousand, nine hundred and eighty-seven.

Seven hundred and fifty-four millions, two-hundred and seventy-four thousand, six hundred and seventy three.

Write in words at length the following numbers:

34	1984	2136759
69	5204	32572464
103	45671	145754273
156	136.78	695972679

ADDITION.

Addition teaches to collect into one sum, or total, several numbers of the same denomination.

EXAMPLES.

82512	74523	42861
53124	21402	54287
31042	15134	87654
64325	63251	12861
65432	54261	42783
296435	228571	240446
476498	384856	575476
858427	576828	256782
345368	246542	343274
465482	682673	575476
623428	722346	256782
232698	232782	343274
73487623	82998763	84987654
43284783	23765436	87236875
24687329	87349235	35976329
72358927	98984687	64136897
67243884	85239496	33297978
79847263	87238643	12315634

69732841	42346740	40312034
76843792	54023647	23443270
43417612	14323624	43204024
67398784	76432940	6234203
48976139	43284324	523430
24643675	73645327	45032302
70385728	65432432	53204272
56320523	23456789	65420743
54335004	75421407	34325436
7654328	7864324	40352042
54342347	43654326	33420043
3294606	43246	50603228
63976542	64320043	37832565
89074234	53243200	84064232
74526488	65320402	46030626
7262540	4230046	42340476
224253	2323624	7652355
65730216	67598325	39567836
5430256	434270	90892347
7653024	43209542	842650
8924204	6534203	70814764
65798432	742302	56430282
46078024	87685997	75643213
7262540	42308046	42347476
2342153	7236243	6652345
65430215	434270	87089234
76302416	5439552	83265
764523	65342083	7084764

SUBTRACTION.

Subtraction teaches to deduct or subtract a less number from a greater of the same denomination, whereby the remainder or difference is found.

EXAMPLES.

From	7613456	948765381	731426871
Take	2347892	578631497	377631268
Remainder	5265564	370133884	353795603
Proof	7613456	948765381	731426871

576504320	876980608	760054367
312321234	141213065	213561213
657345134	827658974	957894761
252176581	245371892	682763457

539876543	760654753	428753145
325678912	254876317	212315668
647514879	598761492	958276134
316321568	342367984	726324189

748763548638402670803146078540 3
327856132548450123454223213282 1

543218765253221230454670000000 0
314216717131654321677828917234 5

MULTIPLICATION.

Multiplication is a compendious method of performing addition, teaching to find the amount of the greater of two given numbers repeated as often as there are units in the less.

The number to be repeated is called the multiplicand: the number expressing how often the multiplicand is to be repeated, is called the multiplier; and the number produced is called the product, or answer.

CASE I.

EXAMPLE.

476548321 multiplicand
2 multiplier

953096642 product

Multiplicand	Multiplier	Product
231042852532	2	
468104261428	3	
102897142634	4	
426941042261	5	
509270860274	6	
987654321234	7	
144869104212	8	
261042785409	9	
540926854261	10	

Multiplicand	Multiplier	Product
437820491276	11	
542907123645	12	
989876421027	12	

CASE II.

When the multiplier is more than 12 and less than 20 multiply by the unit figure in the multiplier, adding to the product the back figure in the multiplicand to the one you multiplied.

EXAMPLE.

542789246891 Multiplicand
13 Multiplier

7056260209583 Product

Multiplicand	Multiplier	Product
654270654212	14	9159789158968
594206142123	15	8913092131845
124670924352	16	1994734789632
426704260142	17	7253972422414
542096512312	18	9757737221616
426012423504	19	8094236046576
542601423126	19	10309427039394

CASE III.

When the multiplier is the product of two or more numbers in the multiplication table, multiply successively by each number, and the last product will be the answer required.

EXAMPLE.

542064358

$4 \times 6 = 24$

2168257432

6

13009544592

Multiplicand	Multiplier	Product
437094285	32	13987017120
760425513	42	31937871546
870354261	56	48739838616
925401326	64	59225684864
542670329	72	39072263688
624506274	81	50585008194
785462501	84	65978850084
862435871	96	82793843616
432014936	121	52273807256
504367218	144	72618879392
513742867	1728	887747674176

CASE IV.

When the multiplier consists of several figures, multiply separately by each of the figures, if ciphers intervene, omit them, and place the unit figure of each product under its corresponding figure in the multiplier, and the sum of these partial products will be the product required.

EXAMPLE.

24230612452 Multiplicand
23 Multiplier

72691837356
48461224904

Prod. required 557304086396

Multiplicand	Multiplier	Product.
56013542634	37	2072501077458
15270253612	43	656620905316
9270426514	65	602577723410
57406423908	76	4362888217008
64212346573	98	6292809964154
1246092544	257	320245783808
5642709431	549	3097847477619
123456789	1342	165679010838
42786581	63452	2714894137612
54306712	72564	3940712249568
560254389	40026	22424742174114
459624137	602004	27669356897054
642042571	4200706	2697032089255126
42802754	5700405	243993032915370

CASE V.

When there are ciphers at the right of one or both numbers, proceed as before, omitting the ciphers, at the right of the product, place as many ciphers as are annexed to both numbers.

EXAMPLE.

254361400 Multiplicand
423000 Multiplier

76308420000
5087228
10174456

10759487220000 Product

Multiplicand	Multiplier	Product
52714230	542100	2746411383000
6435720	8435000	54285298200000
3452640	645200	2208322328000
753264000	5462704	11485525280000
789254400	7831200	6180809072800000
560254389	40026	22424742174114
459624137	602004	27669536897054 8
642042571	4200706	2697032080255126
42802754	5700405	243993032915273
47892541	4250006	203543586605246
54260354	42700205	2316928239172570

DIVISION.

CASE I.

Division is a compendious method of performing subtraction, teaching to find how many times one number is contained in another of the same denomination.

The number to be divided is called the dividend: the number by which we are to divide is called the divisor: the number produced is called the product, quotient, or answer, and if there be any number over, it is called the remaider.

EXAMPLE.

Divisor Dividend
2)732045680

366022840 Product
2

732045680 Proof

Divided	Divisor	Product
724043681	4	
396420157	5	
492874363	6	
567801239	7	
620481954	8	
572860341	9	
654302178	10	
823521457	11	
108605482	12	

CASE II.

When the divisor is the product of two or more numbers in the multiplication table, divide successively by each number, and if there be any remainder from any division except the first, multiply it by the preceding divisors, and add to the product the preceding remainder.

EXAMPLE.

$$15 \begin{cases} 3)843276849 \\ \hline 5)281092283 \end{cases}$$

$$56218456 + 3 \times 3 = 9$$

Divided	Divisor	Product	Remainder
843276849	15	56218456	3
563482684	24	23478445	4
406348276	36	13509674	2
843263243	48	17567984	11
483268420	54	8949415	10
432684794	63	6868012	38
573624836	64	8962888	4
487357647	72	6768856	15
824268475	84	9931767	49
684327684	96	712883	4
768246843	108	7067100	43
326372645	132	2476307	121

CASE III.

When the divisor exceeds 12 and is not a composite number; find how many times the di-

visor is contained in the highest figures in the dividend, by finding the greatest product of the divisor multiplied by a single figure, that is contained in those figures; subtract this product from them, and place the number of times in the quotient; then to the remainder bring down the next highest figure in the dividend, and find how often the divisor is contained in it; place this figure in the quotient, subtract the product, and so proceed through all the remaining figures in the dividend.

EXAMPLE.

```
Divisor Dividend Product
   13)234536(18041 + 8
     13          13
     --          --
     104      234536 Proof
     104      ------
     ---
       53
       52
       --
        16
        13
        --
         3 Remainder.
         -
```

Dividend	Divisor	Product
4278345798	17	251667399
3564279384	19	187593651
2542038749	26	97770721
3921654873	37	105990672
329064578	106	3066645
472945637448	164	1299301201
667964745976	3168	210847457
499743486638 48	3974	1257532678
1979468636602	323124	6126034
4996338299875	364543	13706857
64589742621735	1234625	52315271

CASE IV.

When the divisor has a cipher or ciphers at the right hand of it, separate them from the divisor, also cut off as many places on the right of the dividend, then divide the figures remaining as before, and to the remainder annex the figures separated from the dividend.

EXAMPLE.

Divisor Divdend Product

31,00)65406,00(2109

62	3100
34	210900
31	6327
306	27 Remainder
270	6540600 Proof
27 Remainder.	

Dividend	Divisor	Product
654067752400	3100	210989 43
632687625700	3900	162227596
5042683910	2630	1917370
12326895649380	42060	29307883
643851974480500	4567200	140973019
479463746845000	4635000	103444174
405134068053312360	8767340	462084357
2359753846005837 60	43512678 0	54231409 2

COMPOUND ADDITION.

Addition of Money, Weights, Measures, &c., teaches to add sundry sums or numbers together having divers denominations.

MONEY.

EXAMPLE.

£	s.	d.
5	3	9
6	3	6
7	4	8½
1	9	5
2	14	6¼
1	13	7
3	18	4¼
5	13	8¾
9	16	1¼
43	17	8

£	s.	d.
25	6	1½
67	17	6
76	7	2¾
85	2	9
55	7	5
77	9	7
93	15	9¾
75	16	9
3	3	4

£.	s.	d.
457	19	$6\frac{1}{4}$
547	19	9
498	17	$0\frac{1}{2}$
700	6	3
629	19	$6\frac{1}{2}$
900	6	6
395	19	7
532	14	$5\frac{3}{4}$
792	9	$5\frac{3}{4}$

£.	s.	d.
352	19	6
357	15	$5\frac{1}{2}$
896	4	7
680	15	3
649	5	7
672	18	$1\frac{1}{4}$
423	2	8
274	16	6
960	6	$7\frac{3}{4}$

£.	s.	d.
279	16	$9\frac{1}{2}$
675	18	$5\frac{3}{4}$
698	14	9
667	6	$2\frac{3}{4}$
407	17	4
564	19	$9\frac{3}{4}$
709	8	6
279	7	9
248	14	4

£.	s.	d.
346	16	$7\frac{3}{4}$
360	12	4
209	9	9
776	16	6
467	7	$8\frac{1}{4}$
467	9	$7\frac{3}{4}$
953	16	5
645	19	$8\frac{3}{4}$
797	10	$6\frac{1}{4}$

£.	s.	d.
457	17	7
261	18	8
296	18	3½
384	12	6
547	12	4
270	10	3
320	19	4½
387	15	10
387	12	7

£.	s.	d.
187	19	6
146	15	6
106	17	7
236	18	9½
429	17	10
387	17	7
140	10	6
443	13	4
584	19	10

FEDERAL MONEY.

Eagles.	dol.	dim.	cents.	mills.
4576	7	5	4	9
8963	8	2	3	6
6734	3	4	3	2
5878	4	8	9	7
3421	7	9	7	5
1342	0	6	5	4
2546	1	3	5	3
7234	2	9	6	7
2175	8	7	5	8

TROY WEIGHT.

oz.	dwts.	gr.	oz.	dwts.	gr.
9	10	18	10	18	20
8	18	7	11	17	18
10	19	8	7	14	19
11	12	22	8	9	4
10	7	7	5	19	19
7	8	16	9	8	7
4	14	16	8	15	15
5	17	7	9	9	10
7	18	20	5	18	16

lbs.	oz.	dwt.	lbs.	oz.	dwt.
20	10	18	25	11	12
15	11	12	14	9	18
27	7	17	16	7	3
18	11	10	56	10	10
14	10	19	19	11	17
19	4	18	23	9	18
18	5	17	26	10	10
26	9	18	24	8	12
10	3	19	19	7	12

AVOIRDUPOISE WEIGHT.

lbs.	oz.	dr.	lbs.	oz.	dr.
15	13	14	20	14	12
13	15	12	18	15	14
24	12	10	25	14	13
5	7	9	26	12	10
23	10	7	20	2	13
25	3	15	25	14	12
24	12	14	23	12	13
17	14	12	27	13	9
12	10	15	24	13	12

cwt.	qr.	lbs.	ton	cwt.	qr.
19	3	20	23	18	2
17	2	14	29	19	1
14	0	12	18	6	3
17	1	4	25	18	2
15	0	17	36	10	1
14	2	18	39	19	2
13	0	19	48	14	0
17	2	24	49	2	2
18	1	23	50	2	1

APOTHECARIES WEIGHT.

dr.	sc.	gr.	oz.	dr.	sec.
6	2	18	10	6	0
7	1	14	9	5	1
5	0	19	8	7	2
6	1	14	9	2	0
5	2	16	11	5	2
4	1	19	10	4	0
7	0	18	7	7	1
4	2	19	7	1	0

lbs.	oz.	dr.	lbs.	oz.	dr.
20	1	7	22	10	7
24	4	6	23	6	6
17	5	5	26	9	7
24	9	3	19	8	4
18	6	7	23	11	6
25	10	6	26	10	7
26	9	7	15	9	0
27	9	5	28	7	7
19	8	7	17	9	6

WOOL WEIGHT.

st.	cl.	lb.	t.	st.	cl.
1	0	6	5	1	1
1	1	5	4	1	0
1	0	3	6	0	1
1	1	5	3	1	1
1	0	3	2	1	1
1	0	6	4	0	0
1	1	2	5	1	1
1	0	1	3	1	1
1	1	4	1	0	1

t.	st.	cl.	la.	sa.	w.
4	1	1	21	9	1
6	0	1	18	7	0
5	0	0	9	10	1
3	1	0	8	1	1
6	0	1	7	1	0
2	0	1	29	8	1
1	1	0	19	7	0
1	1	1	8	6	0
5	1	0	27	9	1

CLOTH MEASURE.

yds.	qr.	n.	yds.	qr.	n.
15	2	3	19	2	2
18	3	2	17	3	0
17	2	3	20	2	1
24	1	0	27	3	1
27	3	3	26	0	3
29	2	3	29	0	1
21	3	3	34	3	2
46	2	2	46	1	1
17	0	1	15	3	3

E. E.	qr.	n.	Fr. E.	qr.	n.
54	4	3	47	5	3
61	3	2	38	4	2
74	2	2	38	5	0
75	4	1	43	4	1
64	4	0	32	3	2
77	0	2	45	2	3
78	2	3	89	4	1
54	4	1	9	2	1
56	4	3	36	5	3

LONG MEASURE.

ft.	in.	bar.	yds.	ft.	in.
20	6	1	46	2	7
23	7	2	54	1	6
24	[illegible]	0	73	0	4
64	4	1	65	0	5
74	3	2	39	1	2
59	7	0	24	2	3
49	5	1	55	2	6
38	2	2	33	0	3
20	7	0	98	2	7

m.	fur.	p.	lea.	m.	fur.
24	7	26	37	2	7
27	6	30	31	1	6
30	4	18	42	2	5
40	3	35	52	0	6
52	5	23	46	0	4
46	7	34	64	2	5
56	3	32	57	0	2
42	5	28	76	1	1
28	6	22	33	0	6

SQUARE MEASURE.

a.	r.	p.	a.	r.	p.
47	2	26	51	1	33
46	0	27	60	2	38
54	3	33	57	3	35
56	0	37	48	2	38
78	2	30	59	0	29
84	2	24	64	3	24
85	3	33	63	2	36
95	0	37	34	0	39
99	2	38	67	3	33
.....			.....		
.....			.....		

a.	r.	p.	a.	r.	p.
52	1	27	24	2	27
62	2	18	36	3	23
29	3	19	44	0	28
40	2	29	54	2	34
34	0	28	65	1	26
74	2	33	74	0	36
63	3	24	77	3	28
41	2	32	32	0	29
38	0	24	45	2	30
.....			.....		
.....			.....		

WINE MEASURE.

run.	gal.	qts.	run.	gal.	qts.
47	12	3	24	23	2
57	17	2	33	13	3
62	6	0	44	39	0
54	7	2	56	28	2
57	6	1	78	35	1
54	13	0	86	28	0
62	16	3	74	20	3
43	4	0	87	32	2
17	6	2	42	23	2
.....			.....		
.....			.....		

hhd.	gal.	pts.	tuns.	hhd.	gal.
56	48	8	51	2	38
58	49	2	43	1	40
61	16	0	27	2	20
71	47	1	28	0	23
84	37	3	24	3	30
68	42	0	38	2	14
98	24	3	42	1	46
89	53	2	57	0	32
64	47	3	29	3	29
.....			.....		
.....			.....		

ALE and BEER MEASURE.

ba.	fir.	gal.	ba.	fir.	gal.
62	0	7	44	2	8
63	2	6	29	3	7
46	3	4	56	1	5
37	0	5	38	3	6
39	1	4	48	0	2
41	3	3	29	1	4
40	0	6	38	2	7
42	2	7	49	3	3
49	0	2	34	0	5
.....			.....		
.....			.....		

hhd.	gal.	qts.	hhd.	gal.	qts.
72	23	3	55	23	3
45	20	0	63	14	2
54	33	2	69	24	0
64	32	0	70	28	3
72	28	1	67	29	0
36	29	3	49	32	3
28	23	2	48	18	0
48	38	0	60	28	2
18	32	2	48	37	0
.....			.....		
.....			.....		

DRY MEASURE.

qr.	bu.	p.	qr.	bu.	p.
15	7	3	24	6	3
38		2	39	5	0
48	3	1	34	7	2
34	4	0	49	6	1
57	7	3	38	4	0
60	5	2	37	3	3
38	7	3	36	0	3
49	3	0	90	3	2
48	6	3	88	4	3
.....			.....		
.....			.....		

ch.	bu.	p.	ch.	bu.	p.
71	23	3	87	18	1
76	32	2	88	26	2
64	25	0	80	30	0
88	18	4	82	32	3
98	30	2	36	30	0
86	32	0	76	10	3
38	31	0	77	25	2
33	21	3	78	18	0
47	23	0	89	0	3
.....			.....		
.....			.....		

TIME.

h.	m.	"	d.	h.	m.
48	53	49	54	7	42
54	38	43	56	13	44
62	49	37	67	8	38
83	20	47	58	19	49
60	48	50	70	6	40
72	40	44	76	20	38
44	38	48	49	4	39
64	36	38	30	19	30
81	30	37	52	18	59

w.	d.	h.	mth.	w.	d.
47	6	14	46	2	5
49	6	17	45	3	6
48	0	16	40	1	0
57	6	17	37	2	5
46	5	8	38	0	4
53	4	8	40	2	3
44	3	17	46	0	6
59	0	18	43	3	5
58	2	23	37	3	6

MOTION.

m.	″	‴	m.	″	‴
49	34	34	45	18	24
45	42	56	57	34	10
60	57	49	24	42	28
53	15	24	37	22	3
55	16	57	19	57	10
60	38	38	20	12	2
33	37	39	36	42	10
34	40	40	29	32	50
46	44	44	35	14	26

s.	deg.	m.	s.	deg.	m.
33	29	50	66	18	53
46	28	58	36	27	39
76	16	59	37	14	40
57	29	56	36	23	44
97	20	58	55	14	44
36	0	58	66	15	48
89	26	59	76	3	46
90	27	55	66	4	33
65	8	40	44	15	35

COMPOUND SUBTRACTION.

Subtraction of Money, Weights, Measures, &c., teaches to deduct one sum or quantity from another; one or both of the quantities being of different denominations.

EXAMPES.

£	s.	d.	£	s.	d.
27	18	2¾	42	13	6½
13	15	1	36	14	2¼
14	3	1¾	5	19	4¼
27	18	2¾	42	16	3½

£	s.	d.	£	s.	d.
56	17	8	62	9	4
48	13	4	51	10	3

£	s.	d.	£	s.	d.
154	12	10½	236	16	5½
86	10	6	148	14	6¾

£	s.	d.	£	s.	d.
443	17	$2\frac{1}{4}$	439	10	1
257	17	3	147	19	$4\frac{1}{2}$
.....			.....		
.....			.....		
.....			.....		

£	s.	d.	£	s.	d.
443	18	$4\frac{1}{2}$	454	14	1
265	14	1	105	10	$2\frac{1}{2}$
.....			.....		
.....			.....		
.....			.....		

FEDERAL MONEY.

Eagles	dol.	dim,	cents	mils
6734	3	4	3	2
5876	4	8	9	7
.....				
.....				
.....				

TROY WEIGHT.

oz.	dwt.	gr.	oz.	dwt.	gr.
26	18	21	41	14	15
21	14	18	17	18	14
.....			.....		
.....			.....		
.....			.....		

lb.	oz.	dwt.	lb.	oz.	dwt.
56	10	18	74	9	14
48	9	17	45	8	17
.....			.....		
.....			.....		
.....			.....		

AVOIRDUPOIS WEIGHT.

lb.	oz.	dr.	lb.	oz.	dr.
22	10	8	26	2	6
14	12	6	18	10	14
.....			.....		
.....			.....		
.....			.....		

cwt.	qr.	lb.
12	3	7
2	1	14
.....		
.....		
.....		

ton	cwt.	qr.
48	4	1
23	12	3
.....		
.....		
.....		

APOTHECARIES WEIGHT.

dr.	sc.	gr.
12	0	2
3	1	1
.....		
.....		
.....		

oz.	dr.	sc.
24	6	2
12	5	2
.....		
.....		
.....		

lb.	oz.	dr.
10	6	2
6	7	1
.....		
.....		
.....		

lb.	oz.	dr.
15	4	3
4	3	4
.....		
.....		
.....		

WOOL WEIGHT.

la.	sa.	w.	la.	sa.	w.
21	9	1	36	8	0
18	7	0	24	9	1
.....			.....		
.....			.....		
.....			.....		

la.	sa.	w.	la.	sa.	w.
54	3	1	76	9	0
27	11	1	67	4	1
.....			.....		
.....			.....		
.....			.....		

CLOTH MEASURE.

yds.	qr.	n.	yds.	qr.	n.
38	2	3	64	1	3
34	3	2	15	3	2
.....			.....		
.....			.....		
.....			.....		

EE	qr.	n.	Fr.E	qr.	n.
30	2	3	34	3	2
20	3	3	30	3	3
.....			.....		
.....			.....		
.....			.....		

LONG MEASURE.

ft.	in.	bar.	yds.	ft.	in.
36	4	2	40	2	6
28	5	2	34	1	7
.....			.....		
.....			.....		
.....			.....		

m.	fur.	p.	l.	m.	fur.
12	6	37	76	2	7
9	4	28	43	1	4
.....			.....		
.....			.....		
.....			.....		

LAND MEASURE.

a.	r.	p.	a.	p.	p.
39	1	20	40	2	15
15	2	17	36	0	16
.....			.....		
.....			.....		
.....			.....		

a.	r.	p.	a.	r.	p.
10	0	4	54	0	15
5	1	7	6	1	18
.....			.....		
.....			.....		
.....			.....		

WINE MEASURE.

run.	gal.	qt.	tier.	gal.	qt.
50	2	1	17	14	1
28	4	3	12	15	3
.....			.....		
.....			.....		
.....			.....		

hhd.	gal.	qt.	hhd.	gal.	qt.
62	45	2	60	13	2
58	57	2	54	25	0
.....			.....		
.....			.....		
.....			.....		

ALE AND BEER MEASURE.

barl.	fir.	gal.	barl.	fir.	gal.
20	2	5	34	3	5
18	3	7	27	2	3
.....			.....		
.....			.....		
.....			.....		

hhd.	gal.	qt.	hhd,	gal.	qt.
26	14	1	63	32	1
18	15	2	23	46	2
.....			.....		
.....			.....		
.....			.....		

DRY MEASURE.

qu.	bu.	p.	qu.	bu.	p.
24	0	3	67	1	4
12	3	2	14	3	3
.....			.....		
.....			.....		
.....			.....		

ch.	bu.	p.	ch.	bu.	p.
70	34	6	47	10	9
10	1	5	10	14	7
.....			.....		
.....			.....		
.....			.....		

TIME.

h.	se.	m.	d.	h.	m.
76	43	54	62	18	51
22	28	18	34	5	28
.....			.....		
.....			.....		
.....			.....		

w.	d.	h.
54	6	21
23	5	14
.....		
.....		
.....		

mth.	w.	d.
62	2	3
34	3	5
.....		
.....		
.....		

m.	”	”’
51	28	32
24	37	44
.....		
.....		
.....		

m.	”	”’
37	22	33
18	57	40
.....		
.....		
.....		

m.	”	”’
72	14	32
43	22	58
.....		
.....		
.....		

m.	”	”’
34	23	42
21	10	12
.....		
.....		
.....		

REDUCTION.

Reduction is the changing of numbers from one name or denomination to another retaining the same value, and is performed by multiplication and division. Great names are brought into small, by multiplying by as many of the next less as made one of the greater, adding to the product the parts of the less name, if the number to be reduced be a compound one; and small names are brought into great by dividing by as many of the less as make one of the next greater.

MONEY.

	£	s.	d.	
Reduce	25	14	1	into pence.
				Ans. 6169 pence.

EXAMPLE.

£.	s.	d.
25	14	1
20		
514		
12		
Ans. 6169	Pence.	

	£	s.	d.	
Reduce	17	5	3¼	into farthings.
				Ans. 16573 farthings.
Reduce	346	6	8¼	into farthings.
				Ans. 332481 farthings.
Reduce	351	13	0¾	into farthings.
				Ans. 337587 farthings.

Reduce 6169 pence into pounds.

	£.	s.	d.
Ans.	25	14	1

Reduce 16573 farthings into pounds.

Ans.	17	5	$3\frac{1}{4}$

Reduce 332481 farthings into pounds.

Ans.	346	6	$8\frac{3}{4}$

Reduce 337587 farthings into pounds.

Ans.	351	13	$0\frac{3}{4}$

TROY WEIGHT.

Reduce 37lbs. into grains.

Ans. 213120 grains.

Reduce 3lbs. 10oz. 7dwts. 5grs into grains.

Ans. 22253 grains.

Reduce 18lbs. 6oz. 8dwts. 4grs. into grains.

Ans. 106756 grains.

Reduce 59 lbs. 13dwts. 5 grs. into grains.

Ans. 340157 grains.

Reduce 213120 grains into lbs.

Ans. 37lbs.

Reduce 22253 grains into lbs.

Ans. 3lbs. 10oz. 7dwts. 5grs.

Reduce 106759 grains into pounds.

Ans. 18lbs. 6oz. 8dwt. 4grs.

Reduce 340157 grains into lbs.

Ans. 59lbs. 13dwts. 5grs.

APOTHECARIES WEIGHT.

Reduce 17lbs. into scruples.

Ans. 4896 scruples.

Reduce 27lbs. 7oz. 2drs. 1sc. 2grs. into grains.

Ans. 159022 grains.

Reduce 15lbs. 9oz. 6drs. 2sc. 12grs. into grains.

Ans. 91132 grains.

Reduce 23lbs. 3oz. 5grs into grains.

Ans. 1332005 grains.

Reduce 4896 scruples into lbs.

Ans. 17lbs.

Reduce 159022 grains into lbs.

Ans. 27lbs. 7oz. 2dr. 1sc. 2grs.

Reduce 91132 grains into lbs.

Ans. 15lbs. 9oz. 6dr. 2sc. 12grs.

Reduce 1332005 grains into lbs.

Ans. 23lbs. 3oz. 5grs.

AVOIRDUPOIS WEIGHT.

Reduce 8cwt. 27lbs. 1oz. into ounces.

Ans. 14769ozs.

Reduce 9cwt. 5lbs. into ozs.

Ans. 16208 ozs.

Reduce 35tons. 17cwt. 1qr. 23lbs. 7oz. 15drs. into drams.

Ans. 20571005 drams.

Reduce 146tons. 12cwt. 2qrs. 8lbs. 4oz. 6drs. into drams.

Ans. 84032758 drams.

Reduce 14769 oz. into cwts.

Ans. 8cwt. 27lbs. 1oz.

Reduce 16208 oz. into cwts.

Ans. 9 cwt. 5lbs.

Reduce 20571095 drs. into tons.

Ans. 35 tons. 17cwt. 1qr. 23lbs. 7oz. 13drs.

Reduce 84032758 drs. into tons.

Ans. 146 tons. 12cwt. 2qrs. 8lbs. 4oz. 6drs.

The usual allowance made by wholesale to retail dealers, are Tare, Trett and Cloff. Tare is an allowance for the weight of the package. Trett is an allowance of 4lbs in every 104lbs., or one twenty-sixth for waste. Cloff is an allowance of 2lbs. in every 3cwt. for draught. Gross weight is the weight of the commodity and package. Neat or net weight is that which remains after the allowances are deducted.

Gross weight 12cwt. 14lbs. tare 1cwt. 2qrs. 18lbs. required the net?

Ans. 10cwt. 1qr. 24lbs.

Gross weight 71 cwt. 3qrs. tare 3cwt. 1qr. 5lbs. required the net?

Ans. 68cwt. 1qr. 23lbs.

Gross weight 112cwt. 3qrs. tare 12lbs. required the net?

Ans. 111 cwt. 2qrs. 19lbs.

Gross weight 84cwt. 2qrs. 14lbs. tare 14lbs, per cwt.

Ans. 74 cwt. 5¼lbs.

Gross weight 7cwt. 3qrs. 27lbs. tare 36lbs. trett $\frac{1}{26}$ required the net?

Ans. 7cwt. 1qr. 14lbs.

Gross weight 15cwt. 3qrs. 14lbs. tare 13lbs per cwt. trett $\frac{1}{26}$ required the net?

Ans. 13cwt. 1qr. 27⅛lbs.

Gross weight 20cwt. 1qr. 4lbs. tare 35lbs. per cwt. trett $\frac{1}{26}$ required the net?

Ans. 13cwt. 1qr. 17lbs. $\frac{18}{13}$

Gross weight 6cwt. 2qrs. 24lbs. tare 14lbs. per cwt, trett $\frac{1}{26}$ required the net?

Ans. 5cwt. 1qr. 16lbs. $\frac{6}{13}$

Gross weight 32cwt. 3qrs. 12lbs. tare 14lbs. per cwt. trett $\frac{1}{26}$, cloff 2lbs in 3cwt. required the net?

Ans. 27cwt. 1qr. 25lbs.

Gross weight 64cwt. 3qrs. 8lbs. tare 8lbs. per cwt. trett $\frac{1}{26}$ cloff 2lbs in 3cwt. required the net?

Ans. 50cwt. 1qr. 24½lbs.

Gross weight 28cwt. 2qrs. tare 18lbs. per cwt. trett $\frac{1}{26}$ cloff 2lbs. in 3cwt, required the net?

Ans. 22cwt. 3qrs. 12⅜lbs.

Gross weight 23cwt. 3qrs. 7lbs. tare 31lbs. per cwt. trett $\frac{1}{16}$ cloff 2lbs. in 3cwt. required the net?

Ans. 16cwt. 1qr. 22$\frac{1}{4}$lbs.

WOOL WEIGHT.

Reduce 21 Lasts in weys.

Ans. 484 weys.

Reduce 184 Lasts, 7 sacks into weys.

Ans. 4430 weys.

Reduce 4 tods into pounds.

Ans. 112 pounds.

Reduce 5 tods 1st. 1cl. into pounds.

Ans. 161 pounds.

Reduce 484 Weys into lasts.

Ans. 21 last.

Reduce 4430 weys into lasts.

Ans. 184 lasts, 7 sacks.

Reduce 112 pounds in tods.

Ans. 4 tods.

Reduce 161 pounds into tods.

Ans. 5 tods 1st. 5cl.

CLOTH MEASURE.

Reduce 62yds. 2qrs. 1nail into nails.

Ans. 1001 nails.

Reduce 84Fl. E. 2qrs. 3nls. into nails.

Ans. 1019 nails.

Reduce 40E.E. 3qrs. 2nls. into nails.

Ans. 814 nalls.

Reduce 50Fr. E. 4qrs. into nails.

Ans. 1216 nails.

Reduce 1001nls into yards.

Ans. 62yds. 2qrs. 1nl.

Reduce 1019nls. into Fl. E.

Ans. 84Fl. E. 2qrs. 3nls.

Reduce 814nls. into E. E.

Ans. 40E.E. 3qrs. 2nls.

Reduce 1216nls. into Fr. E.

Ans. 50Fr. E. 4qrs.

LONG MEASURE.

Reduce 7 miles into barley-corns.

Ans. 1330560 barley-corn.

Reduce 273 miles into inches.

Ans. 17297280 inches.

Reduce 50 leagues into inches,

Ans. 9504000 inches.

Reduce 25020 miles into barley-corns.

Ans. 4755801600 barley-corns.

Reduce 1330560 barley-corns into miles.

Ans. 7 miles.

Reduce 17297280 inches into miles.

Ans. 273 miles.

Reduce 9504000 inches into leagues.

Ans. 50 leagues.

Reduce 4755801600 barley-corns into miles.

Ans. 25020 miles.

SQUARE MEASURE.

Reduce 27 acres into poles.

Ans. 4320 poles.

Reduce 484 acres into poles.

Ans. 77440 poles.

Reduce 27 acres, 1ro. 32 poles into poles.

Ans. 4392 poles.

Reduce 4321 acres, 3ro. 34 poles into poles.

Ans. 691514 poles.

Reduce 4320 poles into acres.

Ans. 27 acres.

Reduce 77440 poles into acres.

Ans. 484 acres.

Reduce 4392 poles into acres.

Ans. 27 acres, 1ro. 32 poles.

Reduce 691514 poles into acres.

Ans. 4321 acres 3ro. 34 poles.

WINE MEASURE.

Reduce 19hhds into pints.

Ans. 9576 pints.

Reduce 5 tons into gallons.

Ans. 1260 gallons.

Reduce 13 tons 1 pipe 1hhd. 17gals. 2qts. into pints.

Ans. 27860 pints.

Reduce 46 tons 3hhds. 45 gals. 1pint into pints.

Ans. 94609 pints.

Reduce 9576 pints into hhds.

Ans. 19 hogsheads.

Reduce 1260 galls. into tons.

Ans. 5 tons.

Reduce 27860 pints into tons.

Ans. 13 tons 1pp. 1hhd. 17gals. 2qts.

Reduce 94609 pints into tons.

Ans. 46 tons. 3hhds. 45gal. 1pt.

ALE AND BEER MEASURE.

Reduce 10 barrels of ale into pints.

Ans. 2880 pints.

Reduce 13hhds. of ale into gallons.

Ans. 702 gallons.

Reduce 30 hhds. of beer into pints.

Ans. 12960 pints.

Reduce 242 hhds of beer into pints.

Ans. 104544 pints.

Reduce 2880 pints of ale into barrels.

Ans. 10 barrels.

Reduce 702 gallons of ale into hhds.

Ans. 13 hogsheads.

Reduce 12960 pints of beer into hogsheads.

Ans. 30 hogsheads.

Reduce 104544 pints of beer into hogsheads.

Ans. 242 hogsheads.

DRY MEASURE.

Reduce 128 quarters of corn into pecks.

Ans. 4096 pecks.

Reduce 2 lasts. 1 wey 3 qrs. 2bus 3pks. into gals.

Ans. 1814 gallons.

Reduce 20 chaldrons of coal into pecks.

Ans. 2880 pecks.

Reduce 124 chaldrons of coal into pecks.

Ans. 17856 pecks.

Reduce 4096 pecks of corn into quarters.

Ans. 128 quarters.

Reduce 1814 gallons of corn into lasts.

Ans. 2 lasts, 1 wey, 3qrs. 2bus. and 3pks.

Reduce 2880 pecks of coal into chaldrons.

Ans. 20 chaldrons.

Reduce 17856 pecks of coal into chaldrons.

Ans. 124 chaldrons.

TIME.

Reduce 29 days, 12hours, 45 min. into seconds.

Ans. 2551500 seconds.

Reduce 87 days 23hrs. 15min. 30 seconds into seconds.

An. 7600530 seconds.

Reduce 224 days, 16hr. 49min. 15 seconds into seconds.

Ans. 19414155 seconds.

Reduce 365 days 6hrs. into seconds.
Ans. 31557600.

Reduce 2551800 seconds into days.
Ans. 29 days, 12hrs. 45min.

Reduce 7600530 seconds into days.
Ans. 87days, 23hrs. 15min. 30 seconds.

Reduce 19414155 seconds into days.
Ans. 224 days, 16hrs. 49min. 15 seconds.

Reduce 31557600 seconds into days.
Ans. 365 days, 6 hours.

MOTION.

Reduce 3 degrees 4 min. 15sec. into seconds.
Ans. 11055 seconds.

Reduce 6deg. 29min. into seconds.
Ans. 23340 seconds.

Reduce 11deg. 51 min. into seconds.
Ans. 42660.

Reduce 4 signs 21deg. 20min. 18sec. into secs.
Ans. 508818 seconds

Reduce 11055sec. into degrees.
Ans. 3deg. 4min. 15sec.

Reduce 23340 seconds into degress.
Ans. 6deg. 29min.

Reduce 42660 seconds into degrees.
Ans. 11deg. 51min.

Reduce 508318 seconds into signs.
Ans. 4 signs 21deg. 20min. 18sec.

FRACTIONS.

Fractions are expressions for any assignable part or parts of an integer, thus, $\frac{1}{20}$ or $\frac{5}{4}$ of one pound are assignable parts for 15 shillings.—The figure above the line is called the numerator, and that below the denominator.

The denominator shows how many parts are contained in the integer or whole number, and the numerator shows how many of those parts are designated by the fraction.

Fractions are either proper, improper, compound or mixed.

A proper or simple fraction is when the numerator is less than the denominator, as $\frac{1}{2}$, $\frac{2}{3}$, $\frac{3}{4}$, $\frac{15}{20}$, &c.

An improper fraction is when the numerator exceeds the denominator, as $\frac{5}{2}$, $\frac{8}{3}$, $\frac{110}{11}$, &c.

A compound fraction is the fraction of a fraction, as $\frac{1}{2}$ of $\frac{2}{3}$ of £1, is 6s. 8d.

A mixed number is that which is composed of a whole number and a fraction, as $4\frac{1}{5}$, $12\frac{3}{4}$, &c.

CASE I.

To reduce a whole number to the form of a fraction, place 1 under it for a denominator.

EXAMPLE

Reduce 1 to the form of a fraction: $\frac{1}{1}$ answer.
Reduce 4 to the form of a fraction: $\frac{4}{1}$ answer.
Reduce 7 to the form of a fraction: $\frac{7}{1}$ answer.
Reduce 12 to the form of a fraction: $\frac{12}{1}$ answer.

CASE II.

To reduce a whole number to a fraction of a given denominator. Multiply the whole number by the given denominator, and under the product place the denominator.

EXAMPLE.

Reduce 6 into a fraction whose denominator shall be 4:

$6 \times 4 = \frac{24}{4}$ answer.

Reduce 8 into a fraction whose denominator shall be 5:

$\frac{40}{5}$ answer.

Reduce 9 into a fraction whose denominator shall be 7:

$\frac{63}{7}$ answer.

Reduce 10 into a fraction whose denominator shall be 12:

$\frac{120}{12}$ answer.

CASE III.

To reduce a mixed number to an improper fraction, multiply the whole number by the denominator of the fraction, and to the product add the numerator, for a new numerator which place over the denominator.

EXAMPLE.

Reduce $2\frac{3}{4}$ to an improper fraction:

$2\times4+3=\frac{11}{4}$ answer.

Reduce $14\frac{7}{8}$ to an improper fraction:

$\frac{119}{8}$ answer.

Reduce $79\frac{2}{3}$ to an improper fraction:

$\frac{239}{3}$ answer.

Reduce $687\frac{5}{16}$ to an improper fraction:

$\frac{10997}{16}$ answer.

Reduce $784\frac{21}{31}$ to an improper fraction:

$\frac{24353}{31}$ answer.

CASE IV.

To reduce an improper fraction to its proper terms, divide the numerator by the denominator.

EXAMPLE.

Reduce $\frac{42}{5}$ to its proper terms:

$42\div5=\frac{8}{5}$ answer.

Reduce $\frac{6087}{9}$ to its proper number:

$607\frac{4}{9}$ answer.

Reduce $\frac{7641}{13}$ to its proper terms:

$637\frac{1}{13}$ answer.

Reduce $\frac{2167}{8}$ to its proper terms:

$64\frac{5}{8}$ answer.

Reduce $\frac{3741}{21}$ to its proper terms:

$178\frac{3}{7}$ answer.

CASE V.

To reduce fractions to a common denominator, multiply each numerator into all the denominators except its own, for a new numerator, then multiply all the denominators fo. a common denominator.

EXAMPLE.

Reduce $\frac{5}{8}$ & $\frac{4}{9}$ to a common denominator:

$5\times9=45$
$4\times8=32$ $\frac{45}{72}$ $\frac{32}{72}$ answer.
$8\times9=72$

Reduce $\frac{6}{7}$ & $\frac{5}{9}$ to common denominator:

$\frac{54}{63}$ & $\frac{35}{63}$ answer.

Reduce $\frac{3}{8}$, $\frac{6}{7}$ & $\frac{1}{2}$ to a common denominator:

$\frac{42}{112}$, $\frac{96}{112}$ & $\frac{56}{112}$ answer.

Reduce $\frac{6}{7}$, $\frac{5}{9}$ & 12 to a common denominator:

$\frac{54}{63}$, $\frac{35}{63}$ & $\frac{756}{63}$ answer.

CASE VI.

To reduce a fraction to its lowest terms, divide the terms of the given fraction by any number which will divide both without a remainder, and these products again in the same manner, till it appear that there is no number greater than 1 which will divide them; in which case the fraction is said to be in its lowest term; or divide the denominator of the fraction by the numerator, and if any remain, divide the last divisor by

the remainder continually, till nothing remain. then the last divisor will be a common measure which will divide both the numerator and denominator of the given fraction into its lowest terms.

EXAMPLE.

Reduce $\frac{144}{216}$ to its lowest terms.

$\frac{144}{216} \div 12 = \frac{12}{18} \div 6 = \frac{2}{3}$ answer.

or

114) 216 (1
143

72) 144 (2 $\frac{144}{216} \div 72 = \frac{2}{3}$ answer.
144

Reduce $\frac{576}{768}$ to its lowest term:

$\frac{3}{4}$ answer.

Reduce $\frac{246}{372}$ to its lowest terms:

$\frac{41}{62}$ answer.

Reduce $\frac{122}{576}$ to its lowest terms:

$\frac{1}{3}$ answer.

Reduce $\frac{252}{864}$ to its lowest terms:

$\frac{2}{13}$ answer.

Reduce $\frac{2500}{13500}$ to its lowest terms:

$\frac{5}{27}$ answer.

Reduc $\frac{864}{5768}$ to its lowest terms:

$\frac{247}{279}$ answer.

Reduce $\frac{5134}{8674}$ to its lowest terms:

$\frac{147}{167}$ answer.

CASE VII.

To reduce a compound fraction to a single one, multiply all the numerators together for a new numerator, and all the denominators together for a new denominator; or, when any two terms of the fraction will divide by the same number, it may be done, and the products used instead of them.

Reduce $\frac{2}{3}$ of $\frac{3}{4}$ of $\frac{5}{11}$ to a single fraction:
$\frac{1}{11}$ answer.

Reduce $\frac{2}{3}$ of $\frac{3}{5}$ of $\frac{5}{8}$ to a single fraction:
$\frac{1}{4}$ answer.

Reduce $\frac{4}{5}$ of $\frac{5}{8}$ of $\frac{7}{7}$ to a single fraction:
$\frac{4}{7}$ answer.

Reduce $\frac{3}{4}$ of $\frac{8}{9}$ of $\frac{9}{16}$ to a single fraction:
$\frac{3}{16}$ answer.

Reduce $\frac{2}{3}$ of $\frac{3}{5}$ of $\frac{5}{16}$ to a single fraction:
$\frac{3}{16}$ answer.

Reduce $\frac{1}{2}$ of $\frac{2}{3}$ of $\frac{3}{4}$ of 5 to a single fraction:
$\frac{5}{4}$ answer.

CASE VIII.

To reduce any given quantity to the fraction of any greater denomination retaining the same value, reduce the given quantity to the lowest term mentioned for a numerator, then reduce the integral part to the same term, which place under the numerator, will be the fraction required.

EXAMPLE.

Reduce 9d. to the fraction of a shilling :

$\frac{9}{12} \div 3 = \frac{3}{4}$ answer.

Reduce 16s. to the fraction of a pound :

$\frac{4}{5}$ answer.

Reduce 7 oz. 4dwts. to the fraction of lb. Troy :

$\frac{3}{5}$ answer.

Reduce 3qrs. 3 lbs. 1oz. 12½drs. to the fraction of a cwt.

$\frac{7}{9}$ answer.

Reduce 2qrs. 1⅜ nails, to the fraction of a yard:

$\frac{3}{5}$ answer.

Reduce 6 furlongs, 16 poles, to the fraction of a mile :

$\frac{1}{3}$ answer.

Reduce 3 roods, 20 perches to the fraction of an acre :

$\frac{7}{8}$ answer.

Reduce 45 gallons of wine to the fraction of an hogshead :

$\frac{5}{7}$ answer.

Reduce 30 gallons of beer to the fraction of a barrel :

$\frac{5}{6}$ answer.

Reduce 24 bushels of coals to the fraction of a chaldron :

$\frac{3}{8}$ answer.

Reduce 1 week, 4 days, $4\frac{1}{2}$ hours to the fraction of a month:

$\frac{3}{4}$ answer.

Reduce four minutes, 50 seconds to the fraction of a degree:

$4\frac{1}{6}\frac{7}{2}$ answer.

CASE IX.

To find the proper quantity of a fraction in the known parts, of an integer, multiply the numerator by the common parts of the integer, and divide by the denominator.

EXAMPLE.

Reduce $\frac{3}{4}$ of a shilling to its proper quantity:
$3 \times 12 = 36 \div 4 = 9$d. answer.

Reduce $\frac{4}{5}$ of a pound to its proper quantity:
16s. answer.

Reduce $\frac{3}{5}$ of a pound Troy to its proper quantity:
7oz. 4dwts. answer.

Reduce $\frac{7}{9}$ of a hundred weight to its proper quantity:
3qrs. 3 lbs. 1 oz. $12\frac{4}{9}$ drs. answer.

Reduce $\frac{3}{5}$ of a yard to its proper quantity:
2 qrs. $1\frac{3}{5}$ nail, answer.

Reduce $\frac{4}{5}$ of a mile to its proper quantity:
6 fur. 16 poles, answer.

Reduce $\frac{7}{8}$ of an acre to its proper quantity:
3 roods, 20 perches, answer.

Reduce $\frac{5}{7}$ of an hogshead of wine to its proper quantity:

45 gallons, answer.

Reduce $\frac{3}{8}$ of a barrel of beer to its proper quantity:

30 gallons, answer.

Roduce $\frac{2}{3}$ of a chaldron of coals to its proper quantity:

24 bushels, answer.

Reduce $\frac{3}{5}$ of a month to its proper quantity:

1 week, 4days, $4\frac{1}{5}$ hours, answer.

Reduce $\frac{1}{2}\frac{7}{1}\frac{7}{6}$ of a degree to its proper quantity:

4 minutes, 50 seconds, answer.

ADDITION OF FRACTIONS.

Reduce all the given fractors to simple ones of the same integer and denominator (if not so already) then the sum of the numerator being made a numerator to the common denominator, gives the fractional number required, which may be further reduced as the case will admit.

EXAMPLE.

Add $\frac{2}{3}$ and $\frac{3}{4}$ together:

$$2 \times 4 = 8,\ 3 \times 3 = 9 + 8 = 1\frac{7}{1}$$
$$3 \times 4$$

$\frac{17}{12}$ or 1 $\frac{5}{12}$ answer.

Add $\frac{3}{4}$ and $\frac{5}{6}$ together:

$\frac{1}{1}$ or 1 $\frac{1}{1}$ answer.

Add $5\frac{1}{3}$ and $\frac{3}{4}$ together.

6 $\frac{1}{12}$ answer.

Add $5\frac{3}{4}$, $3\frac{1}{3}$, and $2\frac{1}{3}$ together.

$11\frac{7}{6}$ answer.

Add $\frac{1}{8}$, $\frac{2}{8}$, $\frac{7}{8}$ of a shilling together.

1s. 3d. answer.

Add $\frac{3}{4}$, $\frac{1}{3}$, $\frac{5}{6}$, of a pound together.

£$1\frac{1}{6}$ answer.

Add $\frac{4}{5}$ of a pound to $\frac{7}{8}$ of a shillings.

16s. $10d\frac{1}{2}$ answer.

Add $\frac{8}{9}$ of a pound to $\frac{3}{4}$ of a shilling.

12s. 9. answer.

Add $\frac{3}{4}$ of a shilling to $\frac{3}{8}$ of a pound.

15s. 9d. answer.

Add $\frac{1}{7}$ of a pound. $\frac{2}{3}$ of a shilling, and $\frac{5}{12}$ of a penny.

3s. $1\frac{1}{4}$ $\frac{10}{20}$ answer.

Add $\frac{3}{4}$ of a pound Troy to $\frac{4}{6}$ of an ounce.

9oz. 13dwts. 8qrs. answer.

Add $\frac{3}{5}$ of a ton to $\frac{4}{3}$ of a cwt.

12cwt. 3qrs, 5lbs. 9oz. $9\frac{3}{5}$ drs. answer.

Add $\frac{1}{6}$ of a yard to $\frac{3}{4}$ of an inch.

6 inches, $2\frac{1}{4}$ bc, answer.

Add $\frac{2}{3}$ of a yard to $\frac{3}{4}$ of a foot, and $\frac{3}{5}$ of a mile.

$660\frac{1}{4}$ yards, answer:

Add $\frac{5}{8}$ of 1 chaldron to $\frac{3}{4}$ of a bushel.

27 bush. $3\frac{6}{8}$ pecks, answer.

Add $\frac{1}{3}$ of a week, $\frac{1}{2}$ of a day, and $\frac{2}{3}$ of an hour.

2 days, 14 hours, 20 minutes.

SUBTRACTION OF FRACTIONS.

Prepare the fractions as directed in addition, then subtract one numerator from the other, and the difference written above the common denominator, will give the fraction required.

EXAMPLE.

From $\frac{3}{8}$ take $\frac{2}{8}$.

$2 - 3 = \frac{1}{8}$ answer.

From $\frac{4}{7}$ take $\frac{2}{7}$.

$\frac{2}{7}$ answer.

From $\frac{2}{3}$ take $\frac{1}{3}$.

$\frac{1}{3}$ answer.

From $1\frac{2}{3}$ take $\frac{2}{3}$

$3\frac{1}{3}$ answer.

From $5\frac{1}{2}$ take $\frac{3}{4}$

$4\frac{3}{4}$ answer.

From $\frac{3}{4}$ of a shilling take $\frac{1}{2}$ of a penny.

$8\frac{1}{2}$d. answer.

From $\frac{3}{4}$ of a pound take $\frac{3}{5}$ of a shilling.

14s. 4d. $\frac{4}{5}$ answer.

From $\frac{2}{3}$ of a pound Troy take $\frac{3}{4}$ of an ounce.

6oz. 10dwts. 16grs. answer.

From $\frac{2}{3}$ of a yard take $\frac{4}{6}$ of an inch.

23 inches, 2bc. answer.

From $\frac{2}{3}$ of a chaldron take $\frac{4}{8}$ of a bushel.

23 bushels, 2 pecks, answer.

From 7 weeks take 9 $\frac{7}{10}$ days.

5 weeks, 4 day, 7 hours, 12 minutes, answer.

MULTIPLICATION OF FRACTIONS.

Prepare the given numbers if they require it, then multiply the numerators together for a new numerator, and the denominators for a new denominator.

EXAMPLE.

Multiply $\frac{4}{5}$ by $\frac{6}{10}$

$$\frac{4 \times 6}{5 \times 10} = \frac{24}{50} \text{ answer.}$$

Multiply $\frac{2}{3}$ by $\frac{3}{3}$.

$\frac{2}{3}$ answer.

Multiply $\frac{5}{6}$ by $\frac{2}{5}$.

$\frac{1}{3}$ answer,

Multiply $\frac{1}{6}$ by $\frac{9}{10}$

$\frac{9}{60}$ answer.

Multiply $36\frac{2}{3}$ by $24\frac{3}{4}$.

907 $\frac{6}{12}$ answer.

Multiply $420\frac{3}{4}$ by $32\frac{3}{5}$.

13716 $\frac{8}{20}$ answer.

Multiply $\frac{16}{20}$ by $\frac{3}{4}$ of $\frac{8}{8}$.

$\frac{6}{40}$ answer.

Multiply $4\frac{3}{4}$ by $\frac{2}{3}$.

$3\frac{1}{6}$ answer.

Multiply 32 by $\frac{3}{4}$.

24 answer.

Multiply $\frac{5}{8}$ of 6 by $\frac{4}{5}$.

$3\ \frac{0}{15}$ answer.

Multiply $6\frac{1}{2}$ by $\frac{5}{8}$.

$5\ \frac{5}{16}$ answer.

DIVISION OF ARITHMETIC.

Prepare the fractions (as before directed, if they require it) then multiply the denominator of the divisor by the numerator of the dividend, for a new numerator, and the numerator of the divisor into the denominator of the dividend for a new denominator; or invert the divisor, and proceed exactly as in multiplication.

Divide $\frac{8}{10}$ by $\frac{5}{6}$:

$\frac{24}{25}$ answer.

Divide $\frac{14}{21}$ by $\frac{3}{4}$:

$\frac{8}{9}$ answer.

Divide $\frac{10}{20}$ by $\frac{2}{8}$:

$\frac{8}{4}$ answer.

Divide 384 $\frac{8}{30}$ by 12 $\frac{4}{5}$:

$31\ \frac{5}{20}$ answer.

Divide 9 $\frac{1}{2}$ by 3 $\frac{1}{6}$:

$\frac{1}{3}$ answer.

Divide $\frac{8}{14}$ by 3 $\frac{1}{2}$:

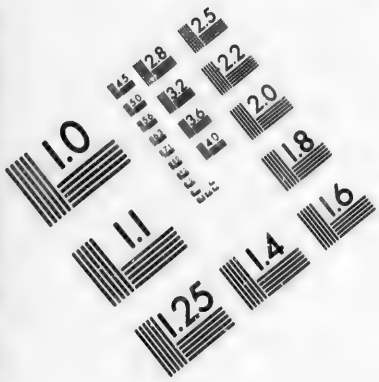
$\frac{1}{7}$ answer.

Divide 20 $\frac{1}{4}$ by 14 $\frac{7}{8}$:

$1\ \frac{172}{176}$ answer.

Divide $\frac{3}{5}$ by $\frac{2}{3}$ of $\frac{3}{5}$ of $\frac{3}{4}$:

$\frac{1}{3}$ answer.



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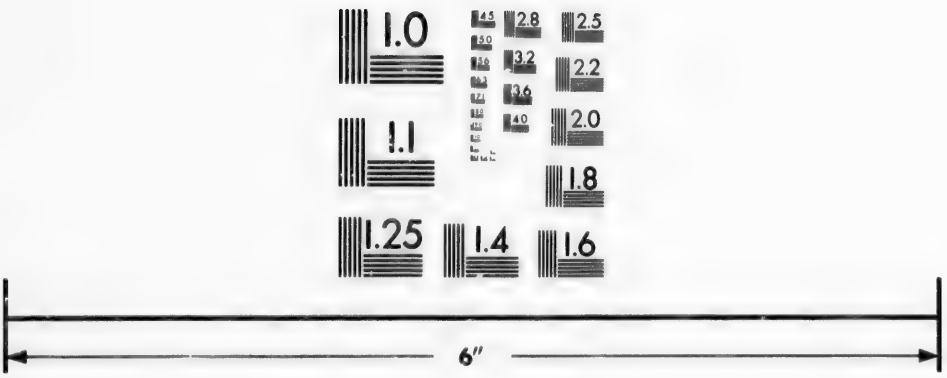

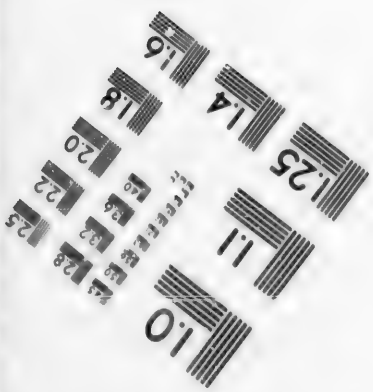

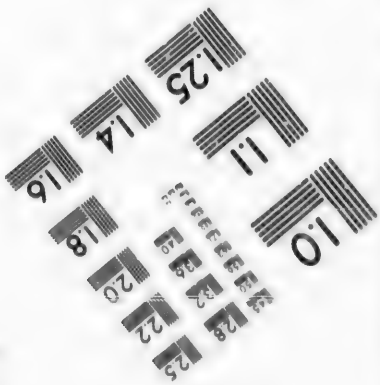

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PROPORTIONAL ARITHMETIC.

Proportional or general arithmetic teaches to find an equivalent to any given quantity at a given ratio.

CASE I.

State the question, that is, place the three given numbers in a straight line, making the term of supposition, which is of the same kind as the term of demand, the first number; that which the term of supposition is said to equal, the second; and the term of demand, the third. Reduce the given numbers into an improper fraction, invert the first term, bring all the terms into a single fraction, then divide the numerator by the denominator, and the remainder will be the answer, which reduced into pounds, shilings, and pence, if required. Proof, reverse the question, or if the price be aliquot parts, divide the quantity by the aliquot part or parts: or if the quantity be component parts, multiply the price by the component parts, and you will obtain the proof or answer required.

EXAMPLE.

Suppose 1 lb. cost a farthing, what will 2476 lbs. amount to at the same rate?

$\frac{1}{1}\ \frac{1}{4}\ \frac{2476}{1} = \frac{9904}{4} = \frac{5}{20} + 7 =$ £2 11s 7d answer.

Suppose 1 lb. cost 5d. what will 6540 lbs. amount to at the same rate?

$\frac{1}{1}\ \frac{5}{1}\ \frac{6540}{1} = \frac{32700}{4} =$ £136 5s. answer.

Suppose 7 cwts. 1 qr. cost £26 10s. 4d. what will 43 cwt. 2 qrs. amount to?

cwt.	qrs.		£	s.	d.	cwt.	qrs.
7	1		26	10	4	43	2
4					6	2	
$\frac{29}{4}$ inverted		$\frac{4}{29}$ 2				$\frac{87}{2}$	3
			140	2	0		

Term of Supposition.	Term of Equality. d.	Term of Demand.	Term sought, or Amount. £	s.	d.
1	$\frac{1}{4}$	4834	5	0	$8\frac{1}{2}$
1	$\frac{1}{3}$	4274	8	18	1
1	$\frac{1}{2}$	9658	20	2	5
1	$\frac{3}{4}$	1253	3	18	$3\frac{3}{4}$
1	$\frac{3}{4}$	6540	20	9	$2\frac{1}{4}$
1	1	1472	6	2	8
1	$1\frac{1}{4}$	2674	13	18	$6\frac{1}{2}$
1	$1\frac{1}{2}$	987	37	8	$4\frac{1}{2}$
1	$1\frac{3}{4}$	9864	71	18	6
1	2	2436	20	6	0
1	$2\frac{1}{4}$	3524	33	0	9
1	$2\frac{1}{3}$	4697	48	18	$6\frac{1}{2}$
1	$2\frac{3}{4}$	8420	96	9	7
1	3	2300	28	15	0
1	$3\frac{1}{4}$	1487	20	2	$8\frac{3}{4}$
1	$3\frac{1}{3}$	8670	100	3	9
1	$3\frac{3}{4}$	2594	40	10	$7\frac{1}{2}$
1	4	4265	71	1	8
1	$4\frac{1}{4}$	8749	154	18	$7\frac{1}{4}$
1	$4\frac{1}{2}$	2380	44	12	6

Term of Supposition.	Term of Equality.	Term of Demand.	Term sought, or Amount.		
	d.		£	s.	d.
1	$4\frac{3}{4}$	1428	28	5	3
1	5	6540	136	5	0
1	$5\frac{1}{4}$	2876	62	18	3
1	$5\frac{1}{2}$	8349	191	2	6
1	$5\frac{3}{4}$	7964	190	16	1
1	6	6481	162	0	6
1	$6\frac{1}{4}$	3874	100	17	$8\frac{1}{2}$
1	$6\frac{1}{2}$	1259	34	1	$11\frac{1}{2}$
1	$6\frac{3}{4}$	4876	137	2	9
1	7	2242	65	7	10
1	$7\frac{1}{4}$	1426	43	1	$6\frac{1}{2}$
1	$7\frac{1}{2}$	3654	114	3	9
1	$7\frac{3}{4}$	4287	138	8	$8\frac{1}{4}$
1	8	2564	85	9	4
1	$8\frac{1}{4}$	9762	335	11	$4\frac{1}{2}$
1	$8\frac{1}{2}$	4879	172	13	$11\frac{1}{2}$
1	$8\frac{3}{4}$	1567	57	2	$7\frac{1}{4}$
1	9	8654	324	10	6
1	$9\frac{1}{4}$	7269	280	3	$2\frac{1}{4}$
1	$9\frac{1}{2}$	8654	342	11	1
1	$9\frac{3}{4}$	2634	107	0	$1\frac{1}{2}$
1	10	7658	319	1	8
1	$10\frac{1}{4}$	9264	395	13	0
1	$10\frac{1}{2}$	1542	67	9	3
1	$10\frac{3}{4}$	4726	211	13	$8\frac{1}{2}$
1	11	8425	386	2	11
1	$11\frac{1}{4}$	2541	119	2	$2\frac{1}{4}$
1	$11\frac{1}{2}$	4862	232	19	5

Term of Supposition.	Term of Equality. s.	d.	Term of Demand.	Term sought, or Amount. £	s.	d.
1		$11\frac{3}{4}$	3698	181	0	$11\frac{1}{2}$
1	1	0	4760	238	0	0
1	1	$0\frac{1}{4}$	3987	203	10	$0\frac{3}{4}$
1	1	$0\frac{1}{2}$	4879	253	19	2
1	1	$0\frac{3}{4}$	1462	77	13	$4\frac{1}{2}$
1	1	1	7641	413	17	9
1	1	$1\frac{1}{4}$	4876	269	3	11
1	1	$1\frac{1}{2}$	2854	160	10	9
1	1	$1\frac{3}{4}$	3876	222	1	3
1	1	2	9268	540	12	8
1	1	$2\frac{1}{4}$	1482	87	19	$10\frac{1}{2}$
1	1	$2\frac{1}{2}$	6947	419	14	$3\frac{1}{2}$
1	1	$2\frac{3}{4}$	7685	472	6	$1\frac{3}{4}$
1	1	3	8764	547	15	0
1	1	$3\frac{1}{4}$	2546	161	15	$6\frac{1}{2}$
1	1	$3\frac{1}{2}$	5467	353	1	$6\frac{1}{2}$
1	1	$3\frac{3}{4}$	9721	637	18	$9\frac{3}{4}$
1	1	4	2427	161	16	0
1	1	$4\frac{1}{4}$	1254	84	18	$1\frac{1}{2}$
1	1	$4\frac{1}{2}$	4726	324	18	3
1	1	$4\frac{3}{4}$	3628	253	4	1
1	1	5	7368	521	18	0
1	1	$5\frac{1}{4}$	2564	184	5	9
1	1	$5\frac{1}{2}$	3271	238	14	7
1	1	$5\frac{3}{4}$	1548	114	9	9
1	1	6	2763	207	4	6
1	1	$6\frac{1}{4}$	4876	370	15	7
1	1	$6\frac{1}{2}$	7424	572	5	4

Term of Supposition.	Term of Equality.		Term of Demand.	Term of or Amount		
	s.	d.		£	s.	d.
1	1	6¾	3876	302	16	3
1	1	7	2743	217	3	1
1	1	7¼	4796	384	13	7
1	1	7½	8562	695	13	3
1	1	7¾	3254	267	15	6½
1	1	8	2642	220	3	4
1	1	8¼	9876	833	5	9
1	1	8½	1486	126	18	7
1	1	8¾	4872	421	4	6
1	1	9	3256	284	18	0
1	1	9¼	2475	219	2	9¾
1	1	9½	5247	470	0	10½
1	1	9¾	1542	139	14	10½
1	1	10	7693	705	3	10
1	1	10¼	2548	235	4	5
1	1	10½	8762	821	8	9
1	1	10¾	3876	367	8	3
1	1	11	4053	388	8	3
1	1	11¼	2769	268	4	11½
1	1	11½	2352	230	6	0
1	1	11¾	9872	976	18	4
1	2	0	2847	284	14	0
1	4	0	3647	729	8	0
1	5	0	2817	704	5	0
1	6	10½	1734	596	1	3
1	7	3½	2547	928	11	10½
1	7	6	1542	578	5	0
1	9	4½	3715	1741	8	1½

Term of Supposition.	Term of Equality. £	s.	d.	Term of Demand.	Term sought, or Amount. £	s.	d.
1	0	10	0	2386	1193	0	0
1	0	12	0	3345	2007	0	0
1	0	12	7	1209	760	13	8
1	0	13	7½	2572	1752	3	6
1	0	14	7½	2510	1835	8	9
1	0	15	0	4825	3618	15	0
1	0	15	7¾	3210	2511	3	1½
1	0	17	6¾	7153	6280	7	0
1	0	19	2½	2710	2602	14	7
1	1	5	7	4613	5900	15	11
1	1	18	6¾	3210	6189	5	7½
1	2	2	6	7965	16925	12	6
1	2	7	4½	2157	5109	7	10½
1	2	15	4½	2175	6022	0	7½
1	3	15	2¼	2517	9462	6	11¼
1	4	3	4	4261	17754	3	4
1	6	1	8	2573	15652	8	4
1	9	6	8	4726	44109	6	8
1	5	5	0	6134	32203	10	0
1	3	13	4	4876	17878	13	4
1	12	15	0	9564	121941	0	0
1	17	16	1½	2150	38282	8	9
1	1	13	3	14	23	5	6
1	0	3	3¾	17	2	16	3¾
1	0	5	9	23⅔	6	16	1
1	7	6	4	25	182	18	4
1	0	12	4½	34½	21	6	11¼
1	1	12	4	53¼	86	1	9

Term of Supposition.	Term of Equality. £	s.	d.	Term of Demand.	Term sought or amount. £	s.	d.
1	0	9	4	64	29	17	4
1	2	14	3¼	65½	177	14	8¾
1	3	15	6¼	73	275	13	0¼
1	1	14	9½	81	140	18	1½
1	8	7	4½	96	803	8	0
1	5	6	5	104½	556	0	6½
1	1	19	8¼	116½	231	3	7
1	20	16	0¼	121	2516	18	6¼
1	2	4	3¼	127¼	281	13	5½
1	25	14	2½	144	3702	6	0
15	3	17	6	1	0	5	2
24	103	10	0	1	4	6	3
59	103	17	7	1	1	15	2½
74¾	107	4	6	1	1	8	8¼
84	54	5	0	1	0	12	11½
86½	95	15	0¾	1	1	2	1
106¼	133	17	10	1	1	5	2¼
132	554	8	0	1	4	4	0
177	432	16	8	1	2	8	10¾
218	636	8	3	1	2	18	4
246	684	8	4	1	2	15	7½
298	705	7	9	1	2	7	4
394	743	12	8	1	1	17	8¾
502	832	12	4	1	1	13	2
647	948	17	9	1	1	9	3¾
846	1008	9	3	1	1	3	10
1129	1265	10	10	1	1	2	5½
2	0	15	0	26	9	16	

Term of Supposition.	Term of Equality. £	s.	d.	Term of Demand.	Term sought or amount. £	s.	d.
3	0	18	0	34	10	4	
4	0	19	0	32	7	12	
6	1	13	7	72	20	3	
7	3	6	6	36	17	2	
8	1	4	0	96	14	8	
9	5	12	0	72	44	16	
14	9	12	0	75	51	8	$6\frac{3}{4}\ \frac{3}{7}$
27	18	14	0	63	43	12	8
54	6	6	0	8	0	18	8
72	6	6	0	9	0	15	9
81	8	18	$10\frac{1}{2}$	10	1	2	1
90	109	2	6	12	14	11	0
99	86	12	6	14	12	5	0
108	42	10	6	15	5	18	$1\frac{1}{2}$

£	s.	d.		£	s.	d.	
9	15	0	26	0	15	0	2
0	18	0	3	10	4	0	34
7	12	0	32	0	19	0	4
20	3	0	72	1	13	7	6
3	6	6	7	17	2	0	36
43	12	8	63	18	14	0	27
0	18	8	8	6	6	0	3
14	8	0	96	1	4	0	8
5	12	0	9	44	16	0	72
109	2	6	90	14	11	0	12
12	5	0	14	86	12	6	99
42	10	6	108	5	18	$1\frac{1}{2}$	15

Term of Supposition.				Term of Equality.			Term of Demand.				Term sought or amount.		
lbs.	oz.	dwt.	gr.	£	s.	d.	lbs.	oz.	dwt.	gr.	£	s.	d.
0	2	0	0	0	0	11	9	0	0	0	2	9	6
0	3	0	0	0	15	3	0	9	0	0	2	5	9
3	0	0	0	1	1	8	29	3	0	0	10	11	3
0	1	0	0	0	6	3	0	7	15	12	2	8	$7\frac{6}{34}$
1	0	0	0	3	6	9	17	15	14	0	61	2	0
0	7	11	0	35	0	0	14	6	12	16	823	9	$3\frac{3}{4}$
cwt.	qrs.	lbs.					cwt.	qrs.	lbs.				
		3		1	1	8			$29\frac{1}{4}$		10	11	3
10	0	0		9	15	0	3	2	0		3	8	3
7	3	0		0	4	0	69	3	0		1	16	6
2	3	14		6	14	2	12	3	0		29	15	0
7	1	0		26	10	4	43	2	0		159	2	0
yds.	qrs.	n.					yds.	qrs.	n.				
7	3	0		2	12	9	140	2	0		47	16	$3\frac{1}{2}$
12	2	0		0	15	9	48	1	0		3	0	$9\frac{1}{2}\frac{2}{3}\frac{2}{1}$
26	2	0		3	16	3	32	1	0		4	12	$9\frac{1}{2}\frac{4}{5}$

Term of Supposition			Term of Equality				Term of Demand.			Term sought or amount.			
£.	s.	d.	lbs.	oz.	dw		£.	s.	d.	lbs.	oz.	dwt.	gr.
0	0	11	0	2	0	0	2	9	6	9	0	0	0
2	5	9	0	9	0	0	0	15	3	0	3	0	0
1	1	8	3	0	0	0	10	11	3	29	3	0	0
0	6	3	0	1	0	0	2	8	$7\frac{6}{32}$	0	7	15	12
823	9	$3\frac{3}{4}$	14	9	12	16	35	0	0	0	7	11	0

			c.	qrs.	lbs.				c.	qrs.	lbs.
1	1	8	0	0	3	10	11	3	0	0	$29\frac{1}{4}$
9	15	0	10	0	0	3	8	3	3	2	0
0	4	0	7	3	0	1	16	0	69	3	0
29	15	0	12	3	0	6	14	2	2	3	14
26	10	4	7	1	0	159	2	0	43	2	0

			yds.	qrs.	n.				yds.	qrs.	n.
47	16	$3\frac{1}{2}\frac{2}{3}\frac{2}{1}$	140	2	0	2	12	9	7	3	0
0	15	9	12	2	0	3	0	$9\frac{14}{2}\frac{}{2}\frac{}{5}$	48	1	0
4	12	$9\frac{1}{2}$	32	1	0	3	16	3	26	2	0

CASE II.

Simple interest is a premium allowed by the borrower of money to the lender; rate is the sum per cent. amount is the principal and interest added together. Multiply the principle or term of demand by the rate on term of equality, and divide that product by the term of supposition, the quotient is the amount sought, or answer for one year, which may be multiplied by the number of years and parts taken for the months, weeks, &c. specified.

Term of Supposition.			Term of Equality.			Term of Demand.			Time.				Term sought. or amount.			
£.	s.	d.	£.	s.	d.	£.	s.	d.	yrs.	m.	w.	d.	£.	s.	d.	
100	0	0	4	0	0	268	0	0	1	0	0	0	10	14	$4\frac{3}{4}$	$\frac{1}{5}$
100	0	0	4	10	0	364	0	0	1	0	0	0	16	17	7	$\frac{1}{5}$
100	0	0	5	0	0	500	10	$6\frac{1}{4}$	1	0	0	0	25	0	$6\frac{1}{4}$	$\frac{1}{4}$
1	0	0	0	1	0	375	0	0	1	0	0	0	18	15	0	
1	0	0	0	0	9	460	0	0	4	0	0	0	69	0	0	
100	0	0	5	0	0	486	0	0	5	0	0	0	121	10	0	
1	0	0	0	1	0	556	13	4	5	0	0	0	139	3	4	
1	0	0	0	1	0	924	0	0	0	2	0	0	7	14	0	
100	0	0	4	0	0	1205	0	0	0	6	0	0	24	2	0	

Term of Supposition. £.	s.	d.	Term of Equality. £.	s.	d.	Term of Demand. £.	s.	d.	Time. yrs.	m.	w.	d.	Term sought or amount. £.	s.	d.
1	0	0	0	1	0	641	0	0	0	0	0	50	4	7	$9\frac{1}{2}+$
100	0	0	4	10	0	2000	0	0	0	0	0	63	15	10	8 +
1	0	0	0	1	0	563	0	0	0	0	0	265	20	9	$2\frac{1}{2}+$

CASE III.

Commission is an allowance made to factors or agents, for buying or selling goods for their employers.

Term of Supposition. £.	s.	d.	Term of Equality. £.	s.	d.	Term of Demand. £.	s.	d.	Term sought or amount. £.	s.	d.
100	0	0	2	0	0	369	0	0	7	7	$7\frac{1}{5}$
1	0	0	0	0	6	500	0	0	12	10	0
100	0	0	3	0	0	748	11	8	22	9	$1\frac{3}{4}+$
100	0	0	2	5	0	529	18	5	11	18	$5\frac{1}{2}$
100	0	0	2	10	0	754	16	0	18	17	$4\frac{3}{4}$
1	0	0	0	0	9	876	5	10	32	17	$2\frac{1}{2}$
100	0	0	5	17	6	1900	0	0	111	12	6

100 0 0 4 0 0 1205 0 0 9 0 0 6 0 24 2 0
1 0 0 1 0 0 924 0 0 2 0 0 0 7 14 0
1 0 0 1 0 0 556 13 4 5 0 0 0 139 3 4

CASE IV.

Brockage is an allowance of so much per cent. made to brokers for assisting others in buying or disposing of goods.

Term of Supposition.			Term of Equality.			Term of Demand.			Term sought or amount.		
£.	s.	d.	£.	s.	d.	£.	s.	d.	£.	s.	d.
100	0	0	0	5	0	640	0	0	1	12	0
100	0	0	0	6	0	796	14	7	2	7	9½
100	0	0	0	6	6	975	6	4	3	3	4½
100	0	0	0	10	0	845	10	0	4	4	6½
1	0	0	0	0	6	202	1	8	5	1	0½
100	0	0	5	0	0	4360	8	4	130	16	3
100	0	0	3	5	0	249	16	4	7	16	6¼

CASE V.

Insurance is an allowance of so much per cent. given to certain persons who engage to make good the loss or damage of ships, houses, merchandizes, &c. which may happen by storms, fire, &c.

Term of Supposition.			Term of Equality.			Term of Demand.			Term sought or amount.		
£.	s.	d.	£.	s.	d.	£.	s.	d.	£.	s.	d.
100	0	0	0	3	6	2860	0	0	5	0	17
100	0	0	0	5	7	7620	0	0	21	8	7½
100	0	0	10	10	0	4680	0	0	491	8	0
100	0	0	6	10	0	1500	0	0	97	10	0
100	0	0	10	15	0	9000	0	0	967	10	0
100	0	0	17	10	0	782	10	0	121	5	9
100	0	0	5	7	6	780	0	0	41	18	6
100	0	0	7	12	6	1200	0	0	91	10	0

CASE VI.

Stock, is a general name for the capitals of our trading companies.

Term of Supposition. £.	s.	d.	Term of Equality. £.	Term of Demand. £.	s.	d.	Term sought. or amount. £.	s.	d.
100	0	0	110	2680	0	0	2948	0	0
100	0	0	120	640	8	0	768	9	$7\frac{1}{2}$
100	0	0	$130\frac{1}{2}$	926	0	0	1208	8	$7\frac{1}{5}$
100	0	0	$84\frac{1}{8}$	1200	0	0	1009	10	0
100	0	0	$96\frac{3}{4}$	577	19	0	559	3	$3\frac{3}{4}$
100	0	0	$104\frac{3}{8}$	1797	14	0	1876	6	$11\frac{3}{4}$
100	0	0	$124\frac{5}{8}$	758	17	10	945	15	$4\frac{1}{4}$

CASE VII.

Discount is the abating so much money on a debt to be received before it is due, as that money if put to interest would gain in the same time and at the same rate per cent.

Bankers and others discounting Bills add three days to the time for the days of grace. As £100 with the interest for the given time is to that interest so is the given sum to the discount required; subtract the discount from the given sum, and the remainder will be the present payment.

Time.	Rate	Term of Supposition.	Term of Equality.	Term of Demand.	Term sought or amount.
y. m. d.	per cent.	£. s. d.	£. s. d.	£. s. d.	£. s. d.
1 0 0	5 0 0	105 0 0	5 0 0	120 0 0	5 14 $3\frac{1}{4}$
1 0 0	5 0 0	105 0 0	5 0 0	50 0 0	2 7 $7\frac{1}{4}$
3 0 0	4 10 0	113 10 0	13 10 0	573 15 0	63 4 $10\frac{1}{4}$
0 3 0	5 0 0	101 5 0	1 5 0	36 0 0	0 8 $10\frac{1}{4}$
0 6 0	6 0 0	103 0 0	3 0 0	312 0 0	9 1 $8\frac{3}{4}$
0 9 78	5 0 0	101 0 0	1 0 0	399 13 4	3 19 $1\frac{1}{2}$

CASE VIII.

Compound Interest is that which arises from both principal and interest taken together, as it becomes due at the end of each stated time of payment. Find the amount of the given principal, for the time of the first payment, by simple interest, then consider this amount as the principal for the second payment, which amount calculate in the same manner, and so on through all the payments, still accounting the last amount as the principal for the next payment.

Term of Supposition.			Term of Equality.			Term of Demand.			Time.			Term sought, or Amount.		
£	s.	d.	£	s.	d.	£	s.	d.	y.	m.	d.	£	s.	d.
100	0	0	5	0	0	50	0	0	3	0	0	57	17	$7\frac{1}{2}$
100	0	0	6	0	0	400	0	0	3	6	0	490	13	$11\frac{1}{4}$
100	0	0	5	0	0	100	0	0	4	0	0	121	11	0
100	0	0	6	0	0	764	0	0	4	9	0	1007	18	8
100	0	0	5	0	0	57	10	6	5	7	15	75	14	$9\frac{1}{2}$

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CASE IX.

Exchange is the receiving or paying any sum owing in one country in the money of another.

The par of exchange is that fixed and intrinsic value of the money of one country compared with that of another.

The course of exchange is a fluctuating price, varying from the par of exchange.

Monies of exchange are of several kinds; viz. current, banco, specie, paper, &c.: all of which may considerably vary in their relative value, either by agio or discount.

Accounts are kept in Ireland, America, and the West Indies, in pounds, shillings, and pence, as in England. In Ireland the difference is as 12 to 13. In Jamaica as 5 to 7. Halifax Currency is as 9 to 10 in favor of England, to which is added a premium of from 5 to 12 per cent. upon Specie and Bills of Exchange.

Term of Supposition.	Term of Equality.	Term of Demand.			Term sought or Amount.		
Sterling.	*Irish.*	*Sterling.*			*Irish.*		
£	£	£	s.	d.	£	s.	d.
100	106	750	0	0	795	0	0
100	110	375	15	0	413	6	6
	Jamaica.				*Jamaica.*		
100	135	212	12	5	287	0	10½
100	150	760	0	0	1089	0	0
100	160	680	18	9	1089	10	0

Sterling.	*Halifax.*	*Sterling.*	*Halifax.*		
£	£	£	£	s	d.
9	10	27	30	0	0
90	100	100	111	2	$2\frac{1}{2}\frac{2}{3}$

Halifax.	*Sterling.*	*Halifax.*			*Sterling.*		
£	£	£			£	s.	d.
10	9	30			27	0	0
100	90	111	2	$2\frac{1}{2}\frac{2}{3}$	100	0	0

Accounts are kept in France in livres, sols, and deniers; exchange being made by the French crown varying from 30d. to 50d. sterling.

NOTE.—12 Deniers make 1 sol of sou.
20 Sols " 1 livre.
3 Livres " 1 ecu or crown tournois.

Term of Supposition.			Term of Equality.				Term of Demand.			Term sought or Amount.		
Crown.	s.	d.	Crown.	li.	s.	d.	£	s.	d.			
1	2	6	1000	0	0	0	125	0	0			
1	4	2	2148	2	4	6	447	13	$1\frac{1}{2}$			
1	2	$7\frac{3}{8}$	785	1	14	0	162	13	$11\frac{1}{2}$			
1	2	$7\frac{1}{8}$	1978	1	5	0	260	13	$11\frac{3}{8}$			

Accounts are kept in Spain in piastres, rials, and marvadies; reckoning 372 marvadies to a rial and 8 rials to a piastre by which they exchange varying from 38d. to 54d. sterling.

NOTE.—In Genoa and Leghorn they keep their accounts in livres, sols, and deniers as in France, but exchange by the piastre as in Spain, which in Genoa is accounted 5 livres, and at Leghorn 6, at Venice accounts are kept by some as in France, by others in ducats and grosso, reckoning 24 grosso to a ducat varying from 52d. to 54d. sterling.

Term of Supposition.	Term of Equality.		Term of Demand.			Term sought or amount.		
Piastres.	s.	d.	Piastres.	r.	mar.	£	s.	d.
1	4	2	6912	0	0	1440	0	0
1	4	0	2600	6	20	520	3	8
1	4	2	2448	0	0	510	0	0
1	4	8	2527	0	0	589	12	8

Accounts are kept in Portugal in milreas and reas, 1000 reas to a milrea exchange from 60d. to 67d. per milrea.

Milrea.	s.	d.	Milreas.	reas.	£	s.	d.
1	5	0	14624	0	3656	0	0
1	5	4	1350	875	360	4	8
1	5	8	2523	528	714	19	11¾

Accounts are kept in Holland, Flanders, and Germany by some in pounds, shillings, and pence as in England, and by others in guelders, stivers, and pennings, 16 pennings making 1 stiver and 20 stivers one guelder, the money of Holland and Flanders is distinguished by the name of Flemish, exchange from 33s. 6d. to 36s. 6d. Flemish per pound sterling, subject to Aigo from 3 to 6 per cent current.

£	£	s.	d.	£	s.	d.	£	s.	d.
1	1	14	0	700	0	0	1190	0	0
1	1	13	6	842	5	0	1410	15	4½
1	1	13	8	314	5	0	528	19	9

Guelds.	Guelders.	Guelders St.					
105	100	2982			2840	0	0
104	100	110	12	0	106	6	0+

Arbitration of exchanges is, in making payments from one country to another, through the monies of several countries, to find the most advantageons way to effect it.

The arbitrated price is that found by a circular course, and when this differs from the direct course, the difference shows the advantage or disadvantage of a circular remittance or exchange.

Ex. 1st.

If the course of exchange between Paris and London be 24 francs per £ sterling, and between London and Lisbon 50 pence per milrea, and between Lisbon and Paris 525 reas per crown, what will be the arbitrated price between Lisbon and London?

Lon. d. Pa. f. Lis. rees.

$$\frac{10 \times 40}{240_{24} \quad 3_3 \quad 10000_{25}} = \frac{400}{7} = 57\tfrac{1}{7} \text{ d. Ans.}$$

$$\ast \quad 24_{24} \quad 525_{25} \quad 21_3 \quad 7$$

Note.—The arbitrated price being required between London and Lisbon, and the pence sterling being the variable number, it is made the blank term, which equals 1 milrea, or 1000 reas,

and 525 reas equal 1 crown, which, to save adjustment, is expressed in francs; and 24 francs equal 1*l.* or 240 pence sterling. The result gives $57\frac{1}{7}d.$

As the direct course of exchange between London and Lisbon is but 50*d.* per milera, it is evident that the circular exchange is in favour of Lisbon, and against London, at the rate of $7\frac{1}{7}d.$ per milrea. Upon this principle the advantages in arbitration of exchanges are discovered.

Ex. 2nd.

From the course of exchange betwen the several places given in Ex. 1, find the arbitrated price between Paris and London.

Pa. f. reas. Lon. d.

8 × 24

$$\begin{array}{cccc} & 40_5 & & \\ 3_3 & 1000_{25} & 240_{10} & 192 \\ \hline * & 525_{25} & 50_{10} & 7 \\ & 21_3 & 5_5 & \\ & 7 & & \end{array} = 27\tfrac{3}{7} \text{ Answer.}$$

NOTE.—This circular exchange gives $27\frac{3}{7}$ francs, and as the direct course is but 24 francs, it must be in favour of London, and against Paris, $3\frac{3}{7}$ francs per £ sterling.

Ex. 3rd.

From the course of exchange between the several places given in Ex. 1, find the abitrated price between Lisbon and Paris.

rees. Lon. d. Pa. f.

$$\frac{200 \times 24_{24}}{1000_{5} \quad 240_{10} \quad 3} = 600 \text{ Lis. rees. Answer.}$$

$$* \quad 50_{10} \quad 24_{24}$$
$$5_{5}$$

This circular exchange gives 75 rees per crown in favour of Paris, and against Lisbon.

CASE X.

Loss and Gain is the discovering what is gained or lost in buying or selling of goods, and instructs merchants, &c. how to raise or fall the price of their commodities so as to gain or lose so much per cent.

Supposition. Term of			Term of Equality.			Term of Demand.			Term sought or amount.		
£	s.	d.	£	s.	d.	£	s.	d.	£	s.	d.
100	0	0	125	0	0	0	13	5	0	16	9¼
100	0	0	112	0	0	500	0	0	560	0	0
0	1	4	0	1	8	100	0	0	125	0	0
0	13	4	0	16	0	100	0	0	120	0	0
0	1	0	0	1	1½	100	0	0	112	10	0
1	0	0	1	3	6	100	0	0	1	10	0
100	0	0	110	0	0	1	10	0	1	13	0
100	0	0	90	0	0	1	13	0	1	9	8¾
1	0	0	0	2	6	100	0	0	12	10	0
100	0	0	115	0	0	0	6	8	0	7	8

CASE XI.

Single Fellowship teaches to divide any given number into any assigned number of parts which shall be proportional to so many other proposed numbers. Make the sum of the numbers to which the required parts must be proportioned, the term of supposition; the quantity to be divided, the term of equality; and each of the given numbers or shares, separately, the term of demand; and each amount will give the respective parts, or answer required; or make one pound the term of demand, the product will give the rate in the pound, which multiply by each person's share, will give the amount due to each.

Two merchants make a joint stock of 1000*l.* W. put in 300*l.* and S. 700*l.* they clear 160*l.* what is the gain in the pound, and what is each person's share?

In the pound 3s. $2\frac{1}{4}$d. $\frac{3}{5}$

W's. share 48*l.*—S's. 112*l.* Ans.

A bankrupt whose effects produce 340*l.* owes A. 120*l.* B. 140*l.* C. 200*l.* and D. 260*l.* what will it produce in the pound, and what is each man's dividend?

In the pound 9s. $5\frac{1}{4}$d. $\frac{1}{3}$

A's share 56*l.* 13s. 4d.—B's 66*l.* 2s. $2\frac{1}{2}$d.—C's 94*l* .8s. $10\frac{1}{2}$d.—D's 122*l.* 15s. $6\frac{1}{2}$d. Ans.

Three persons make a joint stock, D. advances 1500*l.* F. 900*l.* and H. 600*l.* they gain 600*l.* what is each man's share?

D. gains 300*l.*—F. 180*l.*—H. 120*l.*

A tradesman becoming bankrupt owes to H. 520*l.* K. 680*l.* and to N. 800*l.* his effects are worth 920*l.* find each person's dividend.

H. 239*l.* 4*s.*—K. 312*l.* 16*s.*—N. 368*l.*

Three merchants unite in the purchase of a quantity of indigo, C. advanced 2400*l.* B. 9600*l.* I. 4000*l.* in retailing the above, they lost 1600*l.* what sum did each man lose?

C. lost 240*l.*—B. 960*l.*—I. 400*l.*

CASE XII.

Double Fellowship is when equal or different stocks are employed for different times: multiply each man's stock by the time of its continuance, then the sum of the products will be the term of supposition; the whole gain or loss, the term of equality, and each man's particular product, term of demand; and each amount will be the answer required.

Two merchants unite in busines, A. put in 50*l.* for 4 months, and B. 60*l.* for 5 months, at the expiration of which they find they have gained 24*l.* what is each man's share of the gain.

A's share 9*l.* 12*s.* 0*d.*—B's 14*l.* 8*s.* 0*d.*

Three merchants engage in business, A. advances 120*l.* for 4 months, B. 230*l.* for three months, and C. 360*l.* for 2 months, they gain 120*l.* required each man's share of the gain.

A's share 30*l.* 9s. 6¼d.—B's 43*l.* 16s. 2¼d.—C's 45*l.* 14s. 3¼d. Ans.

CASE XIII.

Barter is the exchanging one commodity for another so that neither party may sustain loss; find the value of that commodity whose quantity is given, then find what quantity of the other at the rate proposed you may have for the same money, and it will give the answer required.

NOTE.—It is unnecessary to make two prices when goods are exchanged, for if you calculate by the ready money price, the result will be the same.

How many pounds at 6d. per pound must I give in barter for 30lb at 2s. per pound.

Answer 120lbs.

What quantity at 8s. per lb. must I give in barter for 2 cwt. at 2s. per lb.

Answer 56lbs.

What quantity at 8d. per lb. must be given in barter for 20 cwts. at 3*l.* per cwt.

Answer 16 cwt. 0 qr. 8lbs.

If 6 hogsheads be delivered at 3s. 4d. per gallon for 252 yards of cloth, what was the cloth per yard?

Answer 5s per yard.

CASE XIV.

Equation of Payments is the finding a time, when if a sum of money be paid which is equal to the sum of several others due at different times, so that no loss will be sustained by either party.

The method used by mercantile men, though not exactly correct, yet sufficiently so for most questions that occur in business, is to multiply each payment by the time at which it is due, then divide the sum of the products by the sum of the payments, and the quotient will be the time required.

A debt of 190*l.* is to be paid as follows, viz. 50*l.* at 6 months, 60*l.* at 7 months, and 80*l.* at 10 months, what is the equated time for the payments of the whole?

Answer 8 months.

A debt of 200*l.* is to be discharged, viz. 100*l.* at 4 months, and 100*l.* at 6 months, but if reduced to one payment, at what time must it be made?

Answer 5 months.

A debt of 1000*l.* is payable as follows, viz. 200*l.* cash, 600*l.* at 4 months, and the rest at 6 months, what is the equated time for the whole?

Answer $3\frac{3}{4}$ months.

Compound Proportion teaches to resolve such questions as require two or more statings by simple proportion; make the term of equality, which is of the same kind as the answer, the middle term only; multiply the corresponding terms together, then make the term of supposition, the first term; the term of equality, the second; and the term of demand, the third; and the amount will be the answer required: or make the increasing terms, the numerators, and the decreasing terms, the denominators, then proceed as in proportional arithmetic, and the result will give the answer.

If 100 men in 6 days, of 10 hour each, can dig a trench 200 yards long, 3 wide, and 2 deep, in how many days of 8 hours long, will 180 men dig a trench of 360 yards long, 4 wide, 3 deep.

$$\begin{array}{llllll} 10_{10} & 3 \times & 5 & 2_2 & & \\ 100_{10} & 6_2 & 10_2 & 360_{180} & 4_4 & 3_3 \end{array} = 15 \text{ Ans.}$$

$$\begin{array}{llll} 200_{10} & 3_3 & 2_2 \; 180_{180} & 8_4 \\ 20_{10} & & & 2_2 \\ 2_2 & & & \end{array}$$

Suppose 100*l.* in one year gain 5*l.* interest, what will be the interest of 750*l.* for 7 years?

Answer 262*l.* 10s.

If 27s. be the wages of 4 men for 7 days, what will be the wages of 14 men for ten days.

Answer 6*l.* 15s.

What is the interest of 340*l.* for $2\frac{1}{2}$ years at $4\frac{1}{2}$ per cent, per annum.

Answer 38*l.* 5s.

If the pay of 72 soldiers be 192*l* for 48 weeks, how much will pay 27 soldiers for 24 weeks?

Answer 36*l.*

If the carriage of 13cwts. 1qr. for 72 miles be 2*l.* 10s. 6d. what will be the carriage of 7cwts. 3qrs. for 112 miles?

Answer 2*l.* 5. $11\frac{1}{4}$d.

If 9 students spend 10*l.* $\frac{7}{9}$ in 18 days, how much will 20 students spend in 30 days?

Answer 39*l.* 18s. 4d.

If 1 pay 16s. 4d. for the carriage of $5\frac{1}{4}$ cwts. 20 miles, what must I pay for the carriage of $17\frac{3}{4}$ cwts. $7\frac{1}{2}$ miles.

Answer 1s. $8\frac{1}{2}$d.

If the carriage of 1cwt. 20 miles be $6\frac{1}{2}$d, what will the carriage of 5 cwts. 100 miles amount to?

Answer 13s. $6\frac{1}{4}$d.

INVOICES.

York, U. C. 13th April, 1833.

Mr. John Mansfield,

Bought of Thomas Lloyd.

	£.	s.	d.
1 Ream best post letter paper	0	18	0
Almanack for the present year framed	0	4	0
200 Quills and a box of wafers	0	17	6
A set of books for the counting house	3	3	0
A memorandum book and letter case	0	9	6
A portable writing desk	3	13	6
	£9	5	6

York, U. C. 17th April, 1833.

Messrs. Lee and Johnson,

Bought of Thompson and Smith.

35	Pieces of bombazetts at	19s. per piece.
40	bombazetts	30
20	calimancoes	26
10	bombasins	36
20	"	58
10	"	75
		£232 15s.

York, U. C. 18th April, 1833.

Mr. James Vaveser,

Bought of William Powel.

30	pieces of bombazetts at 25s. 6d. per price	
12	" 44.	
15	bombazins at 70 per piece.	
2	plain cloth each 39 yds at 9s per yd.	
4	coating 37yds. each at 14s.	
2	broad cloth each 36yds. 28s. per yd.	
	Discount 2½ per cent.	
		£399 16 8¾

York, U. C, 20th April, 1833.

Mr. Sylvester,

Bought of Timothy Prior.

	oz.	dwt.	gr.			
A silver waiter weighing	23	4	0	at 5s.	10.	p.oz.
A silver tankard weighing	10	3	6	6	2d.	
A silver teapot and lamp	30	5	12	7	3	
½ doz. silver plates weigh	73	11	5	6	1	
1½ doz silver table spoons weighing	41	0	10	6	3	
						£56 1s. 4d.

York, U. C. 20th April, 1833.

Mr. Thomas Weston,

Bought of Samuel Davis.

49lbs. of Green tea at 9s. 3d. per lb.
42½lbs. 12s.
71⅜lbs. of Bohea tea at 6s. 11d.
17⅜lbs. of coffee at 5. 4d. per lb.
25lbs. double refined sugar 1s. 1½d.
9 loaves weighing 137lbs. 7½d.

£33 5s. 9d.

York, U. C. 21st April, 1833.

Mr. Walter Robarts,

Bought of James Prince.

21⅜lbs. of Indigo at 29s. 6d. per lb.
6¼ opium 6s. 4d.
53⅛ scammony 8s. 10d.
14¾ cohineal 17s.
93 nut galls 10d.
71⅛ gum Arabic 1s. 2½d.
11 sassafras 4½d.

£80 1 0½

DECIMAL FRACTIONS.

Decimal Fractions represent the parts of any integral quantity divided into decuple, or ten-fold proportion.

ADDITION OF DECIMALS.

Write the proposed numbers under each other, according to the value of their places, which may be done by placing the separating points exactly under each other, then add as in whole numbers, placing a decimal point in the sum exactly below the other points.

7·421	1·275	2·73	9·
4·165	·011	1·426	40·23
5·276	·024	9·1	1·44
3·147	1·042	·192	60·03
1·521	3·6	·237	4·28
7·964	·256	6·	·81
4·639	5·641	·542	72·
1·706	·4	·117	2·34
4·329	1·254	2·4	3·49

SUBTRACTION OF DECIMALS.

Place the decimals to be subtracted as directed in addition, then subtract as in whole numbers, placing the decimal points as before.

From	65·21	7·631	5·154	1·000
Take	34·12	4·276	1·925	·731
From	31·42	1·234	6 000	2·713
Take	37·68	·749	·993	1·964

MULTIPLICATION OF DECIMALS.

Multiply the decimals as if they were whole numbers, and from the product cut off as many decimal places as there are in both factors; if there are not so many places, prefix ciphers to supply the defect.

Multiply 79·347 by 23·15
1836·88305, answer.

Multiply ·63478 by ·8204:
·520773512, answer.

Multiply ·3046825 by 23·4
7·12957050 answer.

Multiply 1234·56789 by 478·216243
590390·4180842372?

CASE I.

To contract the operation, so as to retain so many decimal places in the product, as may be thought necessary; transpose all the figures of the multiplier, viz. let the units place stand to the left hand, then make the units place of the transposed multiplier stand under the place of the multiplicand, whose decimal place you intend to retain in the product: proceed as in common multiplication, always having regard to the increase of that figure on the right hand of the figure that stands over your multiplier, carrying 1 from 5 to 15; 2 from 15 to 25, &c. making use of no more places of your multiplier than those which stand even with your multiplicand to the left hand.

Multiply ·3046825 by 23·4 reserving two decimal places in the product:

7·12, answer.

Multiply ·248264 by ·725234 reserving 6 figures, 5 figures, and 4 figures in the product respectively:

·180049, ·18005, and ·1800, answer.

Multiply 1234·56789 by 478·216243 reserving only the integers in the product:

590387·, answer.

DIVISION OF DECIMALS.

Proceed as if they were whole numbers, and from the right hand of the quotient point off as many places for decimals, as the decimal places exceed those of the divisor, if there are not so many, supply the defect by perfixing ciphers.

Divide 85643·825000 by ·321:

13549.094, answer.

Divide 234·70525 by 64·25:

3·653, answer.

Divide ·8727587 by ·162:

5·38739, answer.

CASE II.

To contract the operation so as to retain so many decimal places in the quotient as may be thought necessary. Find (as directed above) what place of decimal or integers the first figure of the quotient will possess, consider how many figures will serve the present purpose, then take as many of the left hand figures of the divisor as are equal to the required number of places in the quotient; in dividing, point one figure of the divisor at each operation, having regard to the increase which would arise from the figures so omitted or pointed off.

÷ 5445·418058734098 by 232·14678 so as to have 2 decimal places in the quotient:

23·45, answer.

÷ 12·169825 by 3·14159 so as to have 5 decimal places in the quotient:

3·87377, answer.

REDUCTION OF DECIMALS.

CASE I.

To reduce a fraction to an equivalent decimal fraction.—Divide the numerator by the denominator, as in division of decimals, and the quotient will be the decimal required.

Reduce $\frac{1}{4}$ to a decimal:

4) 100(= ·25, answer.

Reduce $\frac{1}{2}$ to a decimal:

·5, answer.

Reduce $\frac{3}{4}$ to a decimal:

·75, answer.

Reduce $\frac{3}{8}$ to a decimal:

·375, answer.

Reduce $\frac{7}{12}$ to a decimal:

5833+, answer.

Reduce $6\frac{3}{4}$ to a decimal or mixed number.

6·75. answer.

Reduce $8\frac{1}{12}$ to a decimal or mixed number.

8·333+, answer.

CASE II.

To reduce money, weights, measures, &c. into decimals; Reduce the given quantity into its lowest denominator for a dividend, then reduce the integer into the same denominator for a divisor, the quotient will be the decimal required.

Reduce 18s. to the decimal of a pound.

·9, answer.

Reduce 16s. 9d. to the decimal of a pound.

·83, answer.

Reduce 19s. 5⅓d. to the decimal of a pound.

·972916. answer.

Reduce 8 ounces to the decimal of a lb. Troy.

·666, answer.

Reduce 6 dwts. to the decimal of a lb. Troy.

·025, answer.

Reduce 14 lbs. to the decimal of a cwt.

·125, answer.

Reduce 6 onnces to the decimal of a lb. avoirdupois:

·375, answer.

Reduce 9½ inches to the decimal of a yard:

·263, answer.

Reduce 52 days to the decimal of a year:

·142465, answer.

CASE III.

To find the value of a decimal fraction of an integer:—Multiply the given decimal by the parts of the next inferior denominator, cutting off an equal number of decimals from the product: then multiply the remainder by the next inferior denomination, thus proceed till you have brought it to its lowest parts of the integer.

What is the value of ·68464 of a pound:

13s. 8¼d. +, answer.

What is the value of ·775 of a pound:

15s. 6d. answer.

What is the value of ·0125 of a pound Troy:

3dwts., answer.

What is the value of ·625 of a hundred weight:

2 qrs. 14lb., answer.

What is the value of ·125 of a hundred weight.

14lbs., answer.

What is the value of ·375 of a pound avoirdupois:

6 ounces answer.

What is the value of ·005 of a day:

7 minutes, answer.

PROPORTIONAL ARITHMETIC

By Decimals.

Reduce any of the convenient examples in proportional Arithmetic to decimals, then state the question, multiply the second and third terms together, and divide by the first, and you will obtain the answer required.

EXAMPLE.

If one yard of cloth cost 15s. what will 35 yards amount to at the same rate?

£26 5s., answer.

1·	·75	35·
	35	
	375	
	225	
	26·25	
	20	
	5 ·00	

DUODECIMALS.

Duodecimals, or Cross-Multiplication, is the method used by artificers to ascertain the measurement and value of their materials and work, according to the custom of their respective occupations; the dimensions are generally taken in feet, inches, and parts.—Under the multiplicand write the correspondent denominations of the multiplier. multiply each term in the multiplicand, beginning with the lowest by the feet in the multiplier, placing each result under its respective term, observing to carry an unit from every 12 from each lower denomination to its

next superior: proceed in the same manner with the inches and parts, setting the result of each term, one place more to the right hand, and the sum of the whole will be the product required.

Multiply 8 feet., 4 inches by 5 feet, 3 inches:
43 feet, 9 inches, answer.

Multipiy 8 feet. 5 inches, by 4 feet, 7 inches:
38 feet, 6 inches, 11 parts, answer.

Multiply 12 feet, 6 inches, by 8 feet, 5 inches:
105 feet, 2 inches, 6 parts, answer.

Multiply 9 feet, 8 inches, by 7 feet, 6 inches:
72 feet, 6 inches, answer.

Multiply 7 feet, 6 inches, by 5 feet 9 inches.
43 feet, 1 inch, 6 parts, answer.

Multiply 75 feet, 7 inches, by 9 feet 8 inches:
730 feet, 7 inches, 8 parts, answer.

Multiply 26 feet, 4 inches, by 12 feet 7 inches:
331 feet, 4 inches, 4 parts, answer.

Multiply 45 feet, 6 inches, by 38 feet, 7 inches:
1755 feet, 6 inches, 6 parts, answer.

Multiply 126 feet, 6 inches, by 121 feet, 3 inches
15333 feet, 1 inch, 6 parts, answer.

Multiply 87 feet, 5 inches, by 35 feet, 8 inches:
3117 feet, 10 inches, 4 parts answer.

Multiply 764 feet, 5 inches, by 192 feet 4 inches.
147022 feet, 9 inches, 8 parts, answer.

Multiply 7 ft. 3 in. 3 pts. by 1 ft. 7 in. 6 pts:
11 feet, 9 inches, 9 parts, 4. 6. answer.

Multiply 8 ft. 6 in. 6 pts. by 7 ft. 3in. 4pts.
62 feet, 1 inch, 11 parts, 8 answer.
Multiply 4 ft. 10 in. 6 pts. by 2ft. 4 in. 8 pts.
11 feet, 7 inches, 9 parts, answer.
Multiply 7 ft. 8 in. 6 pts. by 7 feet. 2 in. 8 pts.
55 feet, 8 inches 0 parts, 8. answer.
Multiply 3 ft. 6 in. 3 pts. by 2 ft. 4 in. 6 pts.
8 feet, 4 inches, 4 parts, 1. 9. answer.
Multiply 87 ft. 3 in. 5 pts. by 18 ft. 1 in. 6 pts.
1580 feet, 0 inches, 5 parts. 1. 6. answer.

Reduction of Currencies is changing the money or currency of one state or country to that of another.

1st. To change English money, into Halifax Currency: Add $\frac{1}{3}$ to the Sterling given.

To change Halifax Currency into English Money: Deduct $\frac{1}{4}$.

2nd. To change English Money, the dollar being 4s. 6d: into Federal Money.

Multiply the pounds and decimals of a pound by 40 and divide by 9. To change Federal Money to English, reverse the operation.

To Change Canada and Nova-Scotia currency, the dollar being 5s. or $\frac{1}{4}$ of a pound.

Multiply the sum in pounds and decimals by 4, for Federal Money, and to reduce it to the same currency again divide by 4, the answer will be pounds and decimals of a pound.

To change New-England, Virginia, Kentucky and Tennesee currency to Federal Money, the dollar being 6 shillings, or $\frac{6}{10}$ of a pound:

Reduce the shillings, pence, &c. to the decimal of a pound, annex the same to the pounds and divide by 3, the quotient will be the answer in cents, if there be three decimal figures.

To change Federal Money to New England, &c. currency;

Multiply the given sum by 3 the product will be the answer in pounds and decimals of a pound which may be reduced to shillings, pence and farthings by inspection, or by multiplying by the number of parts in each denomination.

To change New-York, North-Carolina, and Ohio currency, the dollar being 8 shillings or 4 tenths.

Proceed as directed for New England currency, using 4 instead of 3 for a divisor and multiplier.

To change New-Jersey, Pennsylvania, Delaware, and Maryland currency to federal money, the dollar being 7s. 6d. or $\frac{3}{8}$ of a pound.

Divide the given sum in pounds and decimals of a pound by $\frac{3}{8}$, that is, multiply by 8 and divide by 3.

To change federal money to Pennsylvania, &c. currency?

Multiply the sum by 3 and divide by 8, the whole numbers will be pounds; the decimals must be reduced to shillings, &c.

To change S. Carolina and Georgia currency the dollar being 4s. 8d.

Divide by $\frac{7}{30}$, or multiply by 30 and divide by 7 to change it to federal money. To change federal money to the same currency again, multiply by 7 and divide by 30.

A TABLE

Shewing the value of Sterling Money in Halifax Currency, from 1s *to* 1000*l.*

Sterling.		Halifax.		Sterling.		Halifax	
s	£	*s*	*d.*	£	£	*s*	*d.*
1	0	1	$1\frac{1}{4}\frac{1}{3}$	1	1	2	$2\frac{1}{2}\frac{2}{3}$
2	0	2	$2\frac{1}{2}\frac{2}{3}$	2	2	4	$5\frac{1}{4}\frac{1}{3}$
3	0	3	4	3	3	6	8
4	0	4	$5\frac{1}{4}\frac{1}{3}$	4	4	8	$10\frac{1}{2}\frac{2}{3}$
5	0	5	$6\frac{1}{2}\frac{2}{3}$	5	5	11	$1\frac{1}{4}\frac{1}{3}$
6	0	6	8	6	6	13	4
7	0	7	$9\frac{1}{4}\frac{1}{3}$	7	7	15	$6\frac{1}{2}\frac{2}{3}$
8	0	8	$10\frac{1}{2}\frac{2}{3}$	8	8	17	$9\frac{1}{4}\frac{1}{3}$
9	0	10	0	9	10	0	0
10	0	11	$1\frac{1}{4}\frac{1}{3}$	10	11	2	$2\frac{1}{2}\frac{2}{3}$
11	0	12	$2\frac{1}{2}\frac{2}{3}$	11	12	4	$5\frac{1}{4}\frac{1}{3}$
12	0	13	4	12	13	6	8
13	0	14	$5\frac{1}{4}\frac{1}{3}$	13	14	8	$10\frac{1}{2}\frac{2}{3}$
14	0	15	$6\frac{1}{2}\frac{2}{3}$	14	15	11	$1\frac{1}{4}\frac{1}{3}$
15	0	16	8	15	16	13	4
16	0	17	$9\frac{1}{4}\frac{1}{3}$	16	17	15	$6\frac{1}{2}\frac{2}{3}$
17	0	18	$10\frac{1}{2}\frac{2}{3}$	17	18	17	$9\frac{1}{4}\frac{1}{3}$
18	1	0	0	18	20	0	0
19	1	1	$1\frac{1}{4}\frac{1}{3}$	19	21	2	$2\frac{1}{2}\frac{2}{3}$

Sterling.	Halifax.		
£	£	s	d.
20	22	4	5¼⅓
30	33	6	8
40	44	8	10½⅔
50	55	11	1¼⅓
60	66	13	4
70	77	15	6½⅔
80	88	17	9¼⅓
90	100	0	0
100	111	2	2½⅔
200	222	4	5¼⅓
300	333	6	8
400	444	8	10½⅔
500	555	11	1¼⅓
600	666	13	4
700	777	15	6½⅔
800	888	17	9¼⅓
900	1000	0	0
1000	1111	2	2½⅔

N. B,—1s. sterling passes currently in Upper Canada for 1s. 2d. Halifax; a crown for 5s. 9d. or 5s 10d.; a sovereign for £1 3s 9d., or £1 4s Halifax, according to the demand for Specie.

MENTAL CALCULATION.

The most obvious method of finding the value of any number of articles is to multiply the price by the quantity: or of finding the price of one by dividing the cost of any number by the quantity.

The cost of a given number of articles may be found, by reckoning the cost of the given number at prices, easy to be calculated mentally, which together make the given price, and then adding them together make the given price, and then adding them together.

EXAMPLE.—What cost 37 yards at 7d. per yard?

Here 37 sixpences are 18s. 6d. and 37 pence 3s. 1d. which added together make £1. 1s. 7d. the answer.

If any denomination of money be *called* a higher, or lower denomination, it will be the same as multiplying or dividing by the number of times the less denomination is contained in the greater; the application of this remark will greatly assist the mental calculator, and enable him to form rules, simple, concise, and accurate.

EXAMPLE.

To multiply farthings by 4, call them pence.
To multiply " by 48, call them shillings.
To multiply " by 960, call them pounds.
To multiply pence by 12, call them shillings, and each farthing 3 pence.
To multiply " by 240, call them pounds.
To multiply shillings by 20, call them pounds, a six-pence call 10 shillings, three-pence 5 shillings, and a penny 1 shilling and 8 pence.

The reverse of the above rules will be as follows:

To divide pence by 4, call them farthings.
To divide shillings by 48, call them farthings.
To divide pounds by 20, call them shillings.
&c. &c. &c.

Multiplication and division of numbers may frequently be performed by multiplying or dividing by a number greater or less than the one required, and then adding or subtracting a proportional part of the product.

EXAMPLE.—By multiplying by 70, and adding one-tenth of the product, a result will be obtained equal to multiplying by 77: for $\frac{70}{1} + \frac{1}{10}$ of $\frac{70}{1} = \frac{77}{1}$

The amount of any number of tenths may be found, by multiplying by the number of tenths and rejecting the units figure.

EXAMPLE.—What is 4-10ths of 47?

$47 \times 4 = 188$. Answer, nearly 19.

To find the value per dozen, at so much for one.

RULE I.

As many pence so many shillings.

EXAMPLES.

	s.	d.
At 2d.....	2	0
At 3d.....	3	0
At 3½d.....	3	6

So much for one, how much per Score.

RULE II.

As many pence so many shillings, and eight times so many pence.

EXAMPLES.

3d. each.

	s.	d.
3s.....	3	0
3×8d.....	2	0
	5	0

So much for one, how much per Gross.

RULE III.

As many pence, twelve times so many shillings.

EXAMPLES.

4d. each.

	s.	d.
At 4d.×12s.....	48	0
At 5d.×12s.....	60	0

So much per lb. how much the Hundred Weight of 112 lbs.

RULE IV.

As many pence, nine times so many shillings, and so many groats as Pence.

EXAMPLES.

3d. per. lb.

3×9s.....	27	0
3×4d.....	1	0
	£1	8	0

So much for one, how much per hundred of six score, or 120.

RULE V.

As many pence, ten times so many shillings.

EXAMPLES.

2d. each.

	s.	d.
At 2d. × 10s.....	20	0
At 3d. × 10s.....	30	0
At 4d. × 10s.....	40	0

So much per Bushel, how much per Chaldron.

RULE VI.

As many pence per bushel, three times so many shillings.

EXAMPLES.

20d. per bushel.	s.	d.
At 20d. × 3s.....	60	0
At 21d. × 3s.....	63	0
At 28d. × 3s.....	84	0

So much a pound, yard, &c. how much per hundred.

RULE VII.

As many pence, eight times so many shillings, and so many groats as pence.

EXAMPLES.

2d. per lb. yard, &c.

2×8s.....	0	16	0
2×4d.....	0	0	8
	£0	16	8

So much per 100, how much per 1000, as bricks tiles, &c.

RULE VIII.

As many shillings, half so many pounds.

EXAMPLES.

2s. per 100.

Two half pounds.....	£1	0	0

3s. per 100.

Three half pounds.....	£1	10	0

4s. per 100.

Four half pounds.....	£2	0	0

TO FIND THE YEARLY INCOME.

At so much per Day.

RULE IX.

As many pence per day, so many pounds, and so many half guineas, the sum added is the yearly income when leap year; when not, subtract one day's pay.

EXAMPLES.

3d. per Day, how much per Year..

	£	s.	d.
Three Pounds.....	3	0	0
Three half guineas.....	1	11	6
Yearly income	£4	11	6

* The above is for Leap Year.

3d. per Day.

	£	s.	d.
The pounds.....	3	0	0
Three half guineas.....	1	11	6
	4	11	6
Subract one day's pay...	0	0	3
	£4	11	3

Let the Pupil work from one Penny to Twenty Shillings.

To find the Yearly Income at so much per week.

RULE X.

As many shillings twice as many pounds, and twelve times as many shillings.

EXAMPLE.

3s. per Week

	£	s.	d.
3×2.....	6	0	0
3×12.....	1	16	0
	£7	16	0

Examination Table,

OR

A TABLE DESIGNED TO EXERCISE THE PUPILS

IN

Multiplication and in Money.

			s.	£	*s.*	*d.*	*d.*	*s.*	*d.*	*f.*	*d.*
12	× 12	= 144	144	= 7	4	0	144	= 12	0	144	= 36
12	11	132	132	6	12	0	132	11	0	123	33
11	11	121	121	6	1	0	121	10	1	121	30¼
12	10	120	120	6	0	0	120	10	0	120	30
11	10	110	110	5	10	0	110	9	2	110	27½
10	10	100	100	5	0	0	100	8	4	100	25
12	9	108	108	5	8	0	108	9	0	108	27
11	9	99	99	4	19	0	99	8	3	99	24¾
10	9	90	90	4	10	0	90	7	6	90	22½
9	9	81	81	4	1	0	81	6	9	81	20¼
12	8	96	96	4	16	0	96	8	0	96	24
11	8	88	88	4	8	0	88	7	4	88	22
10	8	80	80	4	0	0	80	6	8	80	20
9	8	72	72	3	12	0	72	6	0	72	18
8	8	64	64	3	4	0	64	5	4	64	16
12	7	84	84	4	4	0	84	7	0	84	21
11	7	77	77	3	17	0	77	6	5	77	19¼
10	7	70	70	3	10	0	70	5	10	70	17½
9	7	63	63	3	3	0	63	5	3	63	15¾
8	7	56	56	2	16	0	56	4	8	56	14
7	7	49	49	2	9	0	49	4	1	49	12¼
11	6	66	66	3	6	0	66	5	6	66	16½
10	6	60	60	3	0	0	60	5	0	60	15
9	6	54	54	2	14	0	54	4	6	54	13½
8	6	48	48	2	8	0	48	4	0	48	12

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